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Favorable Position of Electric Public Utilities

FOURTEEN months of war finds the electric utilities of the country in a generally favorable position. While there have been slight handicaps in obtaining sufficient fuel and in financing extensions, not to mention maturing obligations, these troubles have been more or less common to all industries and are part of the price to be paid for liberty. Their weight, however, has not been sufficient to crush, and the sacrifice has certainly been worth while. Manifestly, in war times there must be pain and suffering, losses and personal surrender of conveniences and comforts, of income, of family and of friends. This is so apparent and so inevitable that one marvels at the frantic efforts of the unthinking and unpatriotic to stem the tide of national aspirations and impulses which will bear them on whether they will or not to final victory. Efficiency of production and of use must during war be absolutely insisted on. There must be no waste of men or of material, of labor or of product in the industries essential to the winning of the war, and the less essential industries must be converted to more essential industries as speedily as possible.

Ability to meet demands for power in spite of the irregularities of transport and high cost of fuel have served to establish the principle of central-station power production more firmly than ever, and the coal-zoning system will serve to accentuate its economies. Public utilities, owing to lack of equipment, of fuel and of money, have not always been able to take full advantage of all of the opportunities offered for increasing loads; but this is not altogether a misfortune. Viewed in a certain light, the difficulties of raising money have been advantageous and serve as a check to over-expansion. With the great power shortage that exists throughout the country and a fuel situation destined to become worse with time, the temptation to reach out after supposedly lucrative but in reality short-lived business would, with an easy money market, be hard to overcome.

The necessity for higher rates for electric service, especially for industrial work, is being very generally recognized by public service commissions and by the national administration as well. Not all companies will be able to obtain increases, but a rise in the cost of electric service to consumers will continue to be very general throughout the United States. It was only after a year of war that the necessity for higher rates became apparent in Great Britain, and increases were very generally permitted by the various municipalities throughout that kingdom. New equipment will be increasingly difficult to get unless it can be proved that the generating apparatus is absolutely essential to the conduct of the war. The Fuel Administration is already on record as promising 100 per cent fuel to the central stations of the country, but this presupposes that the fuel will be used efficiently and that the electricity generated from it will be employed only for municipal, domestic and essential industrial purposes.

Owing to many circumstances, the financial outlook has caused some operators much concern. Observation and inquiry, however, fail to reveal any tendency on the part of the public or of the authorities to weaken the integrity of public service corporations or cause them undue embarrassment. It was erroneously supposed by many managers that when their maturing obligations became due or when they needed money for extensions it would only be necessary to certify to these facts before the War Finance Corporation, which would thereupon make the necessary advances. That the War Finance Corporation never had any such notion of its obligations has since become apparent to many managers. If the government requires electrical energy or extensions beyond the power of the utility to furnish, the particular branch of the government desiring the work may advance the necessary funds or the War Finance Corporation may in exceptional cases make loans on excellent security. However, many central stations supplying industries engaged in work both necessary and contributory to the prosecution of the war will not be able to obtain financial relief except through their own efforts. No money for unnecessary work can be obtained by any means.

The demands for electricity will undoubtedly become very much greater as the war progresses, and every facility for increasing the supply through interconnection of systems or other means not involving a greater outlay of fuel, equipment or money will have to be employed. The signs for favorable water-power legislation which will permit hydroelectric development were never so bright, and the disposition of the government is to frown on any further extension of isolated plants and to encourage the use of central-station service everywhere. The government itself is practicing what it preaches and is using public utility service wherever possible, even suggesting an increase in the size of central stations for that purpose. The prospect was never better, and the end of the war should find central stations more efficient as producers and distributers of electricity and more firmly established than ever.

Electric Utilities in the War Program

Taxing Their Facilities to the Utmost, Proving that They Are Highly Essential in War as in Peace, These Properties Have Received Recognition from President Wilson

THE electric public utility is one of the greatest factors in the mobilization of industries for war. Important as it was before the war in the home and industrial life of the nation, it is manyfold more impressive to-day as the source of dependable power for vital industries engaged in making munitions and other strict necessities of life.

Handicaps—and they have been severe in the last year—have not prevented the electric central stations of the country from rendering that uninterrupted service which is one of the main secrets of their usefulness in the economic life of the community.

Meeting demands which tax their facilities to the last kilowatt-hour of possible production in many cities, the managing officials and employees are straining every resource to avoid breakdowns and maintain the supply of energy unimpaired.

Within the industry the significance of the fact that the output has doubled since the beginning of the European war four years ago is generally appreciated, though there is naturally some wonder that the development has been so tremendous, but without the industry it is doubtful if the facts are understood or even known as generally as they should be.

A stabilized business like that of the central stations, involving enormous investment in proportion to the gross turnover, shows under normal conditions a gradual moderate rate of increase from year to year. As a rule this calls for additional investment in fair proportion to the additional business.

Tested by the War

The grim fact of war destroys all precedents, and the electric central station, like all other industries, has been swept into the arena and tested by the rough economic forces which now control the world. It has developed greater production than ever before. It has proved beyond any question that it is in every sense essential to the life, health and comfort of the civilian population and to the successful production of munitions for the military forces. By close, intensive development it has made the utmost use of its generating and line capacity.

It is doubtful if before the war any one having responsible authority took the trouble to appraise the central stations of the country with respect to their value in military defense. Certainly, if military motives had controlled the nation, if industrial efficiency had been regarded as a first requirement, the development of central stations would not have proceeded on very different lines from those actually followed. In other words, the plain truth is that these properties, developed wholly upon ordinary commercial lines, were, because of the high degree of efficiency which they attained, in a position where they were immediately of value in the entire plan of military construction and mobilization.

That this is so may fairly be taken as a tribute to the engineering and managerial bases on which these properties have been built. The American system of large volume output, concentrated production with great generating units, is admitted to be the best one. If it had required justification, which it did not, that justification would have been furnished by the readiness with which the industry met the stern demands of war time.

The Traditional Unfailing Supply

The country is full of instances of service rendered to industries which are producing on an unprecedented scale because of the unfailing supply of electrical energy twenty-four hours a day. This quality of service could not have been rendered if it had not been for the traditional policy. The central stations have not only met the normal increase in demand in their communities, they have anticipated it, and therefore they had a margin in reserve when that margin may have been a powerful element in the successful conduct of the war against unscrupulous Germany.

Central stations are commercial organizations, engaged in business for a profit, and therefore their war work is part of their regular operations. But, lacking the same measure of control over their operations which is held by ordinary commercial institutions, they are feeling in keener degree as time passes the effect of the extraordinary influences resulting from the war. It is for this reason that they have been taking steps to lay the facts before the public and the constituted authorities.

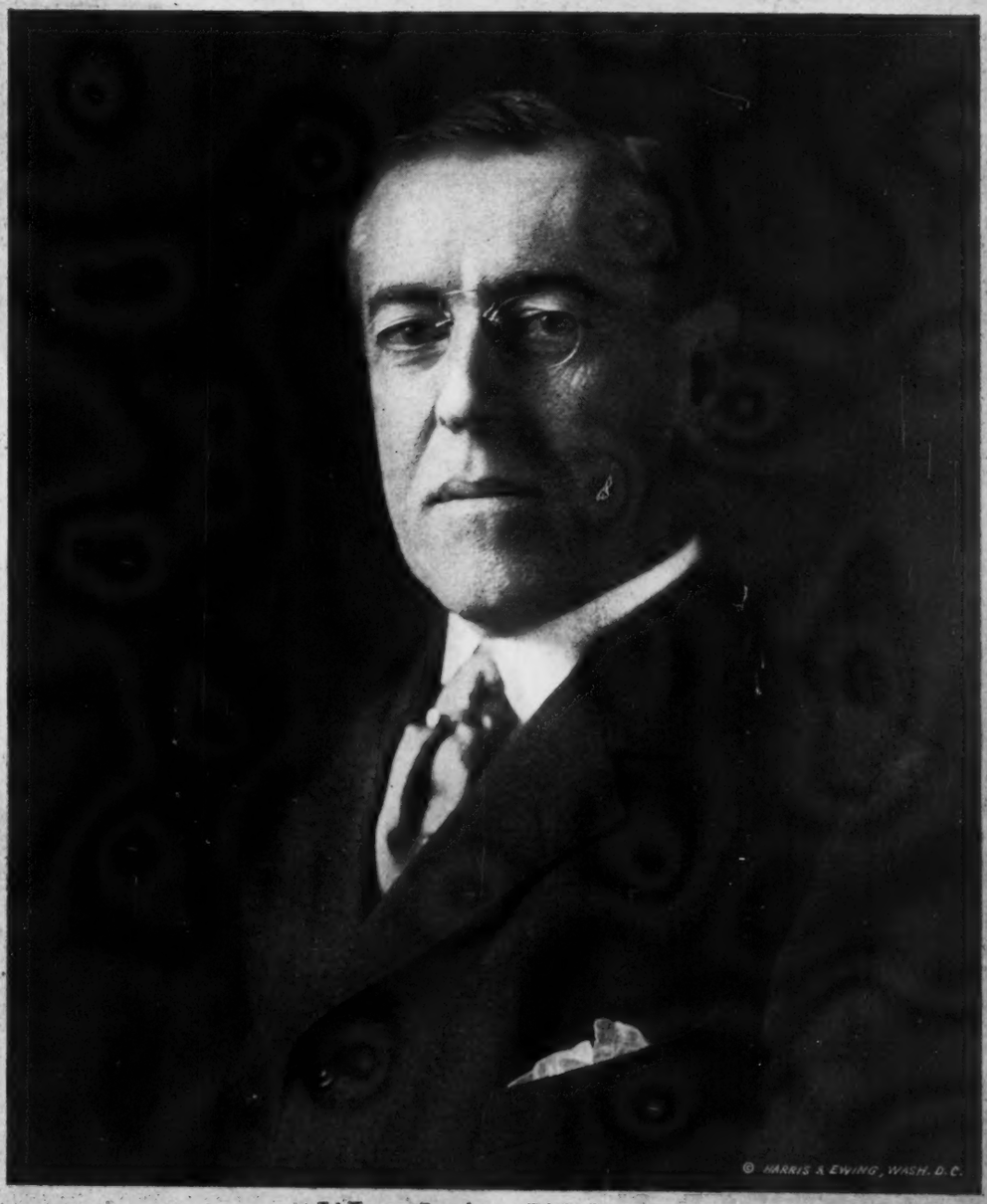
Many properties must have relief in some way if they are to continue to earn a fair return on the investment. Costs are uncontrollable, and the obligation to render service is unavoidable. The regular merchant or manufacturer thinks little of raising prices under similar circumstances. What can the utility do?

Higher Rates Needed

Part of the extra cost of the utility has been absorbed through new economies, greater use of the property, etc. But when the margin of safety becomes smaller month by month and deficit looms in the background the central-station manager is impelled to take radical steps. So far has the principle of regulation been adopted that usually rates can be advanced only by approval of the state public service commission or when no complaint or investigation against such action develops before that body.

Under the present situation the serious needs of the utilities are receiving more consideration than ever before from those not directly responsible to owners of the properties. In many cases commissions have granted relief through higher rates or have refrained from proceeding against advances in schedules because they knew the critical character of the emergency.

The case of the utilities has received recognition in another quarter. When the President of the United States turned from his overwhelming burden of war



Woodrow Wilson,
Liberty War President of the United States

"It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that end in view. I hope that state and local authorities, where they have not already done so, will, when the facts are properly laid before them, respond promptly to the necessities of the situation."

W. G. McAdoo,
Secretary of the Treasury

"It is obvious that every part of our industrial and economic life should be maintained at its maximum strength in order that each may contribute in the fullest measure to the vigorous prosecution of the war. Our local public utilities must not be permitted to become weakened."

responsibility to speak on their behalf, it was an act of conspicuous justice and courage. With Secretary McAdoo and Comptroller of the Currency Williams, President Wilson clearly appreciates the paramount importance of the utilities in the war program and the unescapable conclusion that they must be kept efficient.

NATIONAL COMMITTEE REPORT ON CONDITIONS

Coal Supply Situation in East Far from Satisfactory, New England Anxious, Middle West in Better Shape

A report of the National Committee on Gas and Electric Service, covering recent activities, says in part:

The Fuel Administration has found it necessary to modify the zoning system of bituminous coal distribution and will no doubt make other changes from time to time as conditions arise making these necessary. Among the consumers of the classifications named in preference list No. 1 of the Priority Board who are to receive coal in preference to any other individual or class of consumers, public utilities as a whole are listed.

Every effort is being made by the Fuel Administration to increase production and to secure for all public utilities sufficient coal to permit them to have a reserve for the winter. The situation in the East is far from satisfactory. New England is very anxious regarding future conditions and supply. The Middle West seems to be in much better shape, as we are advised that it is securing reserve stocks. This should go a long way toward carrying it through the winter if it can continue for the next few months to receive coal in the quantities shipped recently.

It is desired to urge all members to make every effort to secure as much storage coal as possible and as soon as possible. This is most important for the future success of their plants. Favorable reports issued from time to time should not lessen the activities of our member companies in securing coal for next winter. Nothing as yet has been decided regarding the cancellation of coal contracts made previous to Aug. 23, 1917.

In furtherance of the determination of the Fuel Administration to prevent the marketing of unclean coal, inspectors have been appointed to designated districts.

The committee has been very active during the last month with the Quartermaster and Ordnance departments in connection with furnishing details as to available power and in making contracts for the additional power required by these several departments.

The War Department in making contracts for electric service with the various electric light and power companies has found that conditions vary in different communities, and in order to avoid complications it contemplates having prepared a form of contract which will be satisfactory to both the public utilities and the War Department and which, it is hoped, will be in accordance with the regulations of the various public service commissions. The public utilities have presented for signature their forms of contract, authorized and regulated in accordance with the view of the public service commissions, and these have varied in numerous instances, as stated; hence the decision of the War Department to issue a uniform contract.

The matter of turbine deliveries to public utilities is becoming more acute all the time, and the War Industries Board finds it necessary practically to assign dates of delivery for the manufacturers in accordance with the importance of the needs of the utilities. While this is not intended as a commandeering process, it has been found necessary in order that the needs of the government for the various plants in construction throughout the country shall be taken care of as to power equipment.

The Interstate Commerce Commission has entered an order setting dates for hearings before Commissioner Aitchison in its investigation preparatory to revising time in accordance with the daylight saving law.

John Skelton Williams,
Comptroller of the Currency

"The continued and increasing efficiency of these corporations is important for the successful conduct of the war. This efficiency is not possible with present conditions."

Electricity Restricted in England

Practically All Central Stations in Areas Where Work of National Importance Is Being Done Are Controlled by the Government as to Extensions, Purchases and Service Connections

IN ORDER that central-station managers in this country may have some concise information on central-station conditions and restrictions in England, the ELECTRICAL WORLD, through its London office, has gathered some pertinent facts on the situation there.

There have been a number of regulations since the commencement of the war which have either directly or indirectly restricted the output of electricity. The first of these restrictions, under the defense of the realm act, was due to the Zeppelin raids. Under this act all external lamps, whether public or private, are extinguished excepting such as are required for the public safety and approved by the Commissioner of Police. Those lamps not extinguished must have all direct light cut off, the only light allowed to escape from the lamp being a diffused light on the ground. Lamps in dwellings, factories and other premises must be reduced in brilliancy and shaded by means of dark curtains so that no more than a dull subdued light is visible outside the building. Only sufficient light is permitted on the tramways to enable fares to be collected.

A slight relaxation in the lighting restrictions took place in 1917, but in the beginning of 1918 a further order was issued prohibiting show-window lighting entirely. This was due to the shortage of generating plant in the power stations and the need for economy in coal. The order also enacted that places of entertainment should not use electricity before 1.30 p. m. and should cease using electricity at 10.30 p. m. Hotels, restaurants and other similar establishments are prohibited from cooking meals between 9 p. m. and 5.30 a. m.

INCREASES IN RATES

Owing to large increases in the price of coal and other material, as well as to the increased wages paid to employees (the increases in the case of coal and wages being authorized or imposed by the government), the price of electricity throughout the realm has been substantially increased. This, of course, has caused consumers to economize further in the use of electric light.

The solicitation of new business has been practically abandoned because it is necessary to obtain permits for consumers' motors or wiring material and for new plant and mains for the generating stations. At present no permits can be obtained except for supply to munition factories or other works of national importance and no services costing over $50 may be fitted without the approval of the government. It should be mentioned in this connection that underground distribution prevails for the most part throughout Great Britain.

Even before these restrictions came into force the extension of generating stations and of service connections was greatly hindered because of the extreme difficulty of getting goods from the manufacturers and the great shortage of labor.

The latest order, which restricts the consumption of electricity south of a line drawn from the Wash to the Bristol Channel, was promulgated on April 2, 1918. Its issue became imperative in the national interest owing to the reduced output of coal arising from the shortage in means of transport and the withdrawal of large numbers of men from the mines.

The order provides that the consumption of electricity by any consumer for any purpose whatsoever must not be more than five-sixths of the amount used on the same premises during the corresponding quarter of the years 1916 and 1917, whichever was the greater. "Premises" means any place in which electricity is consumed, and any portion of the premises supplied by a separate connection is deemed to be a separate premise.

In no case is the consumer compelled to reduce his consumption below the quarterly amounts set out in the "schedule to the order," reproduced here, but if this did not exceed the amount in the schedule his consumption must not exceed his previous consumption in the same quarter of 1916 and 1917.

SCHEDULE TO THE ORDER

Quarter of the Year	Kilowatt-hours
March 25 to June 24	20
June 24 to Sept. 29	20
Sept. 29 to Dec. 25	40
Dec. 25 to March 25	40

Consumers who made any material alterations in their installations between March 25, 1917, and March 25, 1918, may apply to the utility company for an assessment.

If the consumer did not occupy the premises during the whole of 1917, the utility company will, on application, state what amount may be consumed during any quarter for which comparative figures are not available to the consumer. If dissatisfied with the company's assessment, the consumer may appeal to the Board of Trade.

The Board of Trade may grant licenses on special grounds exempting persons or premises from the provisions of the order, which does not apply to establishments controlled under the munitions of war act, 1915, or to hospitals or premises which are and were on March 21, 1918, bona fide nursing homes.

Additional restrictions applicable to hotels, restaurants, clubs and places of entertainment, also prohibiting the lighting of shop fronts, are set forth in the order.

Infringements of the order are summary offences against the defence of the realm act.

Each utility company is compelled to report to the Board of Trade any person whose consumption appears to exceed that permitted by the order. The indications are that the maximum amount of electricity that may be consumed for domestic and shop purposes will be definitely fixed shortly.

The restrictions on purchase of materials began to be felt early in 1916, when the Minister of Munitions by virtue of the powers conferred upon him under the

defense of the realm act issued certain orders restricting the purchase and use of certain classes of materials, chief among which were steel and copper.

Utilities Are Essential Industries

Central stations were authorized to place ordinary orders other than for steel and copper under rules establishing this order of priority: (a) Repairs to existing industrial machinery but not the replacement of old machinery by new; (b) the maintenance of reasonable stocks of materials for approved contracts; (c) export orders properly certified; (d) contracts necessary for the conduct of the war; (e) other contracts certified as important in the national interest. In the case of large orders for generating equipment application is to be made to the Ministry of Munitions for a special permit. Special permits must also be obtained for the purchase of steel and copper.

The supply of electricity by most of the London companies has been certified by the Ministry of Munitions under Clause 9 (1) (d) of the munitions of war (amendment) act, 1916, to be essential to the conduct of the war. These utilities are subject to the regulations of the ministry as regards recruitment of employees and execution of orders, but are in a stronger position than those industries which are uncertified, which as regards protection of employees from military service must rely on appeals to tribunals.

The indispensable employees of the "certified" undertakings are protected under a schedule of protected occupations issued by the Admiralty, War Office and Ministry of Munitions.

Central stations desiring turbo-generators, motors, boilers, switch gear, etc., must obtain a permit from the ministry before the material can be purchased. There is a severe restriction on the manufacture of watt-hour meters, and a special permit for the purchase of new meters is necessary.

There are five existing grades of priority in force at present, namely, P.1, P.2, P.3, P.4, P.5. Generally, new plant equipment is bought under P.4 certificates, and for stores and other similar materials nothing higher than a P.5 certificate is issued.

Central stations in large metropolitan districts like London have special authority from the ministry for the issue of priority certificates for material and work necessary for maintaining their stations. These certificates are as follows:

(*a*) Class A P. 4, authorizing the purchase of materials and work necessary for any urgent repair necesitated by an occurrence in the nature of a breakdown to maintain existing running machinery and plant. A copy of the order has to be sent to the ministry, and if the classification for the work is queried notification will be given by the ministry to this effect within seven days.

(*b*) Class B P. 5, for repairs and materials for repairs to maintain in working order the existing plant and customers' installations. No new units of machinery, however small, even in the nature of replacement, to be ordered under this permit. This permit does not cover requirements for new meters, cable required for use outside the power station, lead or articles composed wholly or partly of lead. A report of all material purchased under this ministry permit must be sent in monthly.

Severe restrictions are enforced on the use of lead-sheathed cables, and a special ministry permit, which is only issued for war work or work of real national importance, is necessary in each case for their purchase. Generally speaking, the ministry eventually grants permission for the purchase of lead-sheathed cables for extra high-voltage working and also, in many cases, for high-voltage working, although almost invariably the ministry first requests the use of cables without lead covering. Permission to purchase lead-covered cable for low-voltage working is granted in very exceptional cases only.

Service Connections

The Ministry of Munitions raises no objection to additional connections being made, subject to the utility's compliance with the following conditions:

(1) That it has adequate generating plant capacity available.

(2) That no lead-covered cable is used on the connection.

(3) That the cost of connection (including any mains extensions) to be borne either by the utility or by the consumer does not exceed £10 ($50).

(4) That the utility forward to the director of electric power supply at the end of each month a list of consumers connected during the month, giving name, address, purpose (*e.g.*, private house, ironmonger's shop or paint manufacturer), kilowatts installed and cost of connection.

Where additional power is required the utility is requested by the ministry to give this information:

(1) Whether it is willing to undertake the work.

(2) The amount of power to be taken.

(3) The present load on the power station.

(4) Length and size of cable, quantity and specification of other articles and materials required for the job, and whether the same are in stock.

(5) Margin of available plant in power station.

Coal Situation

Practically all extensions of supply have been limited to those required for war work. The demands, however, have been so great that the majority of public supply undertakings have largely increased their output.

A consideration of great importance has been that of fuel economy, and power users generally have been much more disposed to use the public supply than to generate their own power on account of increased difficulties in obtaining coal.

The coal transport problem has led to restrictions being imposed in the south of England, but up to the present no restriction on coal consumption has been applied in the north, where the coal fields are situated. It appears, however, that restrictions may become necessary on account of the large reduction in the number of men working in the coal mines, and in such case no doubt consideration will be paid to the fuel consumption of the various plants, and, other needs being equal, the most inefficient will be shut down.

Other restrictions foreshadowed include a considerable reduction in tramway and electric railway services, including the underground services of London, and the rationing of London in coal next winter on a much lower scale than in the past. It is proposed to extend rationing to the greater part of England.

The power companies which supply wide industrial areas have taken a very large part in meeting the war demands. Munition factories have been erected in all parts of the country, and existing works have been converted, with the aid of the public supply, from their normal trade to war work with a minimum of delay.

War Expansion of Washington's Utilities

Needs of Government in New Public Buildings and at Camps and Cantonments Are Being Met Before Wants of Private Consumers, and Even Steam Heat Is Furnished as a War Necessity

THE Potomac Electric Power Company is doing its full share to aid in winning the war and, in line with this endeavor, has been obliged greatly to expand its equipment and facilities to meet needs brought about by the erection of many additional government buildings in Washington and the establishment in and around the capital of many camps and cantonments. The company, of which J. C. McLaughlin is general manager, now has nineteen substations, of which two were erected in the past year. Many of the others have been increased in size, and the company is now building still another, which will make twenty in all. The electricity generated is used as far as Bluemont, in the mountains of Virginia, and as far as the heart of Baltimore.

ENLARGEMENT OF STATION

As was made necessary by the general increase in business and by anticipation of a still further increase, the company installed a new 15,000-kw. unit in January, 1917, at the main plant, Benning, D. C., and then placed an order for an additional 15,000-kw. unit, which is promised for delivery July 5, 1918. To take care of this additional equipment it has been necessary to extend the turbine room, to build a new boiler room, and to place an order for delivery July 1, 1918, for four Babcock & Wilcox boilers of 1000 hp. each. The company is also erecting two new reinforced-concrete stacks, 205 ft. (62.48 m.) high and 12 ft. 6 in. (3.8 m.) in diameter, each one large enough for four 1000-hp. boilers. Anticipating still further demands, the company is now negotiating for a complete duplication of these boilers and another 15,000-kw. set.

Some of the nineteen substations in use serve the Washington Railway & Electric Company, of which system the Potomac Electric Power Company is a corporate part, but most of the war expansion of the power company has been for the purpose of serving government needs for heat, light and power in new government buildings in Washington. It is interesting to note that some of this service is steam heat. As a consequence of the necessity for serving the government first, the power company has been obliged to delay serving private customers; but there is very little if any complaint on this score in Washington, as the power company has always been on the best of terms with the Washington public, enjoying an enviable reputation among public service companies, and, in addition, the Washington public is well trained to the idea that the government must come first in these war times.

Most of the company's expansion has been accomplished without meeting many obstacles, except in the matter of finance, a difficulty common to most public utility corporations recently. The officials of the power company have had the advantage of working closely with government officials, however, on expansion needs, and are now endeavoring to be of assistance in solving some of the problems which are coming up in connection with the housing of war workers in Washington. The company is preparing to furnish steam heat for this housing, when the sites are finally decided upon, and if these sites shall be in the neighborhood of Fourteenth and B Streets, as is expected, it is said to be practically decided that the company will furnish steam heat from its plant in that neighborhood. This will be done at a great saving for the government, for the steam heat will be furnished at a cost much less than would be involved if the government were obliged to put up heating plants and produce heat.

SUPPLYING NEW GOVERNMENT BUILDINGS

When the new government buildings in the section of the city which lies southwest of the White House were erected it was necessary for the power company to

purchase ground in that neighborhood and erect a building, at Eighteenth and D Streets, known as Substation No. 19. This station is rated at 2000 kw. and serves the buildings of the Council of National Defense, the United States Fuel Administration, the United States Food Administration, the War Trade Board and one of the great ordnance buildings. The company also installed a 500-kw. rotary in the substation owned by the government at Sixth and B Streets, N. W., where there are additional ordnance buildings, the construction department of the army, etc. In addition to the 500 kw. in this government substation, the government is to install two additional units of 500 kw. each at its own expense, and the company is to operate the substation and furnish the energy.

For the new Army and Navy Building at Nineteenth and B Streets, which in point of ground space will be the largest office building in the world, the government is erecting a substation and will install two 750-kw. units to be operated by the government, the energy to be furnished by the power company. All these units will probably be tied in with the company's through-wire Edison system.

For the company's Substation No. 10, on I Street between Fourteenth and Fifteenth Streets N. W., the company has ordered one 1350-kw., 250-volt rotary; for the company's Substation No. 13, on Sherman Avenue N. W., the company has ordered one 1250-kw. frequency-changing set; for the company's Substation No. 12, at Thirty-third and K Streets N. W., the company has ordered one 750-kw., 2400-volt frequency-changing set, and the company has installed in its substation at Fourteenth and B Streets N. W., known as No. 16, one 1000-kw., 250-volt generator set. Last December, owing to the increased demand for energy, it was necessary for the company to start up its old reciprocating plant at Fourteenth and B Streets N. W. This has a rating of 3500 kw., made up of 250-volt generators, and from it 1800 kw. is furnished to the railway company.

The Bureau of Engraving and Printing, the work of which, notably in the printing of the Liberty bonds, has greatly increased as a result of the war, has ordered and is installing a 500-kw. rotary converter to help take care of increased energy furnished by the power company. The new Navy Department annex building, now being erected on the site of the old Arlington Hotel, at Vermont and I Streets N. W., will be supplied by the company's Substation No. 10, rated at 1350 kw. The new Treasury Department annex, now being erected at the corner of Pennsylvania Avenue and Madison Place, next door to the Belasco Theater, in which the War Risk Insurance Bureau is to be housed and which will be connected with the main Treasury building by a tunnel under Pennsylvania Avenue, will also probably be supplied from the company's Substation No. 10. At the Bureau of Standards there is an increased load due to war demands, and it has been necessary for the power company to order a 350-kw. rotary converter to care for this.

When the daylight saving act went into effect the company's peak load dropped about 7000 kw. It is expected that the company will get that back again when time changes back to the old basis—Nov. 1. The company is obtaining equipment in anticipation of this increased load. Its estimated expense for improvements and additions contracted for last year and being installed now amounts to $1,250,000. With the new 15,000-kw. equipment this item will run $300,000 more, In addition, the underground conduit expense alone will amount to an additional $100,000. The company's station output has increased 20 per cent. A new source of revenue is found in the fact that the company has contracted to furnish to the government from its plant at Fourteenth and B Streets N. W. steam heating to the extent of 3000 to 4000 boiler-hp. It is intended to heat the new Army and Navy Building, at Nineteenth and B Streets N. W., with steam, as well as the government office buildings being built on Four and One-half and Sixth Streets.

Serving Outlying Points

The company is supplying service to many out-of-the-way places, as well as to Fort Myer, Va., where the officers' training camps and other training camps are located; to American University Park camp, where engineers are being trained; to the Washington Steel & Ordnance Company, opposite Alexandria, Va., on the Potomac River, where shells and other munitions are made; to the Washington Navy Yard, where naval guns are made; to the sea-plane hangars on the Eastern Branch of the Potomac River; to the Washington Barracks, where engineers are trained, and to the Army War College, on the Potomac River; to the high-powered radio station at Arlington, Va.; to the Camp Meade cantonment, between Baltimore and Washington; from the Bennington station through the Washington, Baltimore & Annapolis Electric Railway to Annapolis; to Mount Vernon and Alexandria through the Washington & Virginia Railway, and to Bluemont, Va., in the mountains, through the Washington & Old Dominion Railway. Some of these points are 100 miles (160.9 km.) apart.

Government Still Calls for Technical Men

An urgent call for high-grade technical men and operatives to fill war positions in industrial establishments is made through the Civil Service by the United States Army Ordnance. Salaries ranging from $1,600 to $6,000 a year will be paid the men who qualify. Chemists and chemical engineers, men experienced in the manufacture of gas—mechanical engineers on high-pressure apparatus—engineers to take charge of power houses and foremen of machine shops are needed. Persons of military age accepting appointment will not avoid the obligations of the selective service law.

The Army Ordnance in issuing its call for these men is insisting on one point. No applications will be accepted from government employees or employees of firms or corporations engaged in contracts for the government or its allies unless written assent to such application is given by the head of the establishment that might be seriously handicapped in its war work by the loss of the man.

Power-house engineers will be paid $1,800 to $2,400 a year while working for the Ordnance Department. Supervision of operation of water-tube boilers, condensers, pumps, steam turbines and alternating-current and direct-current generators and motors are among the duties of these men. Machine-shop foremen with salaries from $1,800 to $2,400 also are wanted by the Army Ordnance. Ten years' experience as machinists—three years in a responsible supervisory capacity—is required.

War Conservation of Power and Light

Interconnection of Generating Systems, Elimination of Duplicate and of Uneconomical Plants, Maximum Use of Water Power and Careful Watch of Machinery in Factories Planned by Fuel Administration

BY CHARLES E. STUART

Chief of Power and Light Division, United States Fuel Administration

GENERAL plans have been laid for the conservation of light and power by the Bureau of Conservation of the United States Fuel Administration, of which P. B. Noyes is director, and these plans will be carried out by the power and light division. They will be developed under the following subdivisions:

1. Elimination of uneconomical isolated plants.
2. The application of the "skip stop" to railways and the regulation of car heating and lighting.
3. Economy in utilization of power and light in factories.
4. Utilization of excess water power and interconnection of power systems.
5. Limiting the production of power to the most efficient plants available.
6. Economy in the refrigerating and ice-manufacturing industry.

A brief statement with respect to each of these subd visions follows.

The plans will be carried out through the co-operation of the following:

First—A force of engineers organized and stationed with the Fuel Administration at Washington.

Second—The engineering department of the United States Geological Survey.

Third—The power division of the Council of National Defense.

Fourth—A state fuel engineer attached to the office of the state fuel administrator, to supervise the activities in his state.

Fifth—The Public Service Commissions and state regulatory bodies.

Sixth—The chambers of commerce and similar representative business bodies.

Seventh—Volunteer engineers throughout the country.

The following gives the scope of the subdivisions:

ELIMINATION OF UNECONOMICAL ISOLATED PLANTS

The individualistic way in which fuel is now consumed in cities is not efficient. A ton of coal burned in a large central station will produce at least four times as much electric power as if burned in the average small plant, and if centralized burning could be introduced to a greater extent the amount of fuel required could be reduced without reducing in any way the ultimate production of light and power.

It is sometimes the case that in buildings where there are electric plants and where exhaust steam is utilized in the heating of the building and in furnishing hot-water requirements central station service can be adopted without a loss of money and at a saving in fuel.

As a rule it may be stated that where no extensive heating system is operated in conjunction with the generating plant such a plant can purchase power at a great fuel saving and with a possible reduction in power cost. In other cases it would be more economical, from the viewpoint of fuel saving, to utilize central-station service in conjunction with isolated electric plants.

It is the duty of the Fuel Administration to devise means for securing a curtailment in the use of fuel in ways which will impose a minimum of hardship. It is believed that there are many plants not only in New York but throughout the entire country which could, at least temporarily, shut down their own electrical machinery and purchase power from others at a financial advantage to both and with a considerable saving in fuel.

The Fuel Administration believes that if even a comparatively small proportion of the plants throughout the country which could save fuel in this way at a profit to themselves would do so, it would prove a tremendous help in meeting the fuel situation with which the country is confronted and in winning the war.

While it may appear that the interests of the central station are being benefited to a large degree, such is not of necessity the case. In some cases central stations may be shut down. In any event any connection between a central station and a building or a manufacturing plant that is affected will of necessity be for the period of the war only or through the period where the coal situation is critical. The machinery of the isolated plant can be readily preserved through this period of necessity. Under these circumstances the heavy expense attendant upon the making of the connection by the central station may completely offset, or even more than offset, any profit which could be expected of such a load through a short period.

APPLICATION OF "SKIP STOP" TO RAILWAYS AND REGULATION OF CAR HEATING AND LIGHTING

One of the most promising methods by which we are securing economy in the use of fuel throughout the country is by the introduction of the "skip stop" system on the electric railways of the various cities.

With the present practice of having cars stop on signal at any street corner, there are usually from twelve to fourteen stopping points per mile. With the "skip stop" system, properly applied, these are reduced to not more than eight per mile in the business districts, six per mile in residence districts and four per mile in the open country. With the number of stopping points decreased in this way, a saving of from 10 to 15 per cent can ordinarily be effected in the power and hence in the fuel required, while at the same time the average speed of the cars is increased, without any increase in the maximum speed, and the service thus improved. Since this measure secures economy in fuel not only without handicapping the service, but with an actual improvement, it is obviously an extremely desirable type of conservation measure.

Our plan is to secure the adoption of the system by

voluntary co-operation between the railway companies and the various municipal authorities or state commissions and to bring about this co-operation through the federal fuel administrators for the several states. These administrators are all men of influence in their communities, and so far we have found in every case that a request from the state administrator to the proper authorities was all that was necessary to secure permission for the introduction of the system as a conservation measure during the war. With permission thus provided for, the railway companies have all been glad to adopt the plan.

Through our efforts, through the independent efforts of various local administrators or through the efforts of certain railway companies themselves, the "skip stop" system has been adopted, or is about to be adopted, as a coal conservation measure in Detroit, Washington, Baltimore, Brooklyn, Cincinnati, Columbus, Dayton, Toledo, Indianapolis, Evanston and South Bend, Ind.; Newark and the other cities of New Jersey, New Haven and all the other cities of Connecticut, and in Oakland, Berkeley and Alameda, Cal.

The Connecticut Company has reported a saving in fuel of 10 per cent for its New Haven lines, and reports indicate saving in the other places at rates varying from 3600 tons per year in Columbus to 21,000 tons per year in Detroit.

Various schemes for reducing car heating have been contemplated, but as yet no definite plans have been formulated.

Economy in Utilization of Power and Light in Factories

The United States Fuel Administration is requesting, as a means of accomplishing power and light conservation in manufacturing and industrial establishments, the appointment by the management of a shop committee, composed of those best suited for the purpose and in size or number suitable to the size of the plant, one member of this committee to act as its chairman. The committee is to be active with and have charge of all details in the operation of the plant that would in any way contribute to economy in fuel or the things which fuel is used to produce and to report weekly to the management or head of the plant. It is also suggested that this committee be changed from time to time, so that the spirit and interest in this work may be maintained.

It is not the purpose arbitrarily to outline in detail the method for doing this work, but rather to suggest in a general way, leaving the details and adaptation of the plan in the hands of the manufacturers interested, as we realize that conditions in different plants and character of manufacture as well as organization will have a bearing on the size, character and details of the committee, which must be suited to the particular case under consideration.

As typical illustrations of possible waste and opportunity for conservation, we mention the following:

1. Lights being unnecessarily burned.
2. Lamps of too high candlepower.
3. The elimination of carbon lamps in favor of tungsten lamps where practicable.
4. The elimination of arc lamps and substitution of nitrogen-filled lamps, which are from two to three times as efficient.
5. The restricted use of sunlight owing to dirty windows.
6. Operation of motors when machinery is idle.
7. Excessive sparking, heating or erratic speed of motors.
8. Improper alignment of shafting.
9. Grouping of machines so as to operate motors or engines as nearly loaded as possible.
10. Staggering of operations so as to maintain as flat a load curve as possible.
11. Slipping belts.
12. Dry bearings.
13. Overheated or underheated parts of plant.
14. Excessive drafts due to lack of proper protection about openings of doors, windows, elevator and staircase areas.
15. The reduction of elevator service or the application of a "skip stop" to it.
16. The testing of power circuits for relationship of capacity to load carried.
17. The paralleling of power circuits.

We also suggest that the work of this committee be conducted in such a manner as to provide records of savings, which could be incorporated in reports and information desired from time to time as to the progress of this work.

The War Industries Board and the United States Fuel Administration are laying particular stress on the assistance that can be rendered by industries in economizing in the use of fuel and power. For the purpose of recognition of the individual service and interest of the members of committees, the government will designate and identify them with a button or badge which will be furnished by the United States Fuel Administration.

The endeavor to bring about conservation by the above means is well under way in several sections of the country. Reports which have come in show savings in fuel ranging from 10 to 34 per cent.

Utilization of Excess Water Power and Interconnection of Power Systems

A method of fuel conservation which promises a certain amount of immediate relief and at the same time opens up a field with almost limitless possibilities for future development is the interconnection of the present power systems of the country and the consequent utilization of considerable excess water power which is at present available.

In many parts of the country duplicate transmission systems exist, serving practically the same territory. An interconnection between these systems for the mutual exchange of energy would in many cases result in marked economies. In other cases the lines of a power company which derives all or nearly all its energy from water power may extend very close to the lines of another company which uses coal to a large extent for the generating of power. Since no company is so fortunate as to be operating with a 100 per cent load factor, there are necessarily times during light load when the water-power company is forced to allow unproductive water to flow over its dam. At such a time a great saving in fuel would be effected were the two companies tied together and the load on the steam station transferred in part or entirely to the water-power plant. Numerous hydroelectric companies have for a long time

been carrying out this idea within their own systems, where the bulk of their power is derived from water, and at the same time they maintain a steam reserve to carry their load during low-water periods.

In some cases these system interconnections would involve a considerable expenditure of both time and money, in which event they would not be subject to immediate aggressive action by the administration but would be held in abeyance as possibilities for future consideration and development. In a great many instances, however, very considerable savings can be effected with a minimum of delay and expense, and it is along these lines that the first efforts will be most energetically directed.

LIMITING THE PRODUCTION OF POWER TO THE MOST EFFICIENT PLANTS AVAILABLE

We have been able to locate nearly 500 instances throughout the country where there exists in one form or another a duplication of power production and supply. In other words, there are communities where two or more central stations are furnishing electrical energy with systems paralleling one another.

In certain instances the results of such a condition are not serious, and in many cases they are probably unavoidable. Our investigations so far, however, have proved that a very large percentage of these situations offer an opportunity for large fuel conservation.

We find very often that an arrangement can be made at little or no expense whereby paralleling systems might be connected and the entire load supplied from the more economical station. In some cases possibly the combined load of both systems would be greater than could be handled by the more economical station. In such case as much load as possible should be carried by the station having the highest efficiency and the remainder taken by the other.

ECONOMY IN THE REFRIGERATING INDUSTRY

In co operation with the joint commission on refrigeration which was organized to assist the government during the war, the power and light division is planning to get in touch with the entire ice industry and to introduce a number of proved economies in the operation of ice and refrigerating plants.

A number of suggestions have already been made by the commission and by individuals connected with the industry. One plan that possesses merit and has possibilities of considerable fuel saving is that of allotting a definite amount of coal to individual plants, depending upon the size and type of plant, such allowances being based upon a reduction of 10 to 15 per cent of the average present fuel consumption. This will make it necessary to adopt many simple measures of economy that are now being overlooked.

Another possibility is that of producing white or opaque ice at a fuel saving of 5 to 20 per cent. This is accomplished by eliminating the power that is usually used for agitation in raw-water plants and for producing distillate in distilled-water plants, both of which are merely means of producing a transparent product. This is possible of adoption in many territories.

A further line of effort which will be productive of considerable economy, and one that was successfully applied last winter, is that of operating during the winter season only the most efficient plant or plants, as the particular case requires, in communities where during the summer season all plants are required. This can be done and the individual business of each manufacturer will not be interfered with, as the arrangement provides that the operating plant or plants will sell at wholesale rates to those manufacturers whose plants are temporarily closed down. This arrangement also produces a saving in ammonia, and for this reason it was applied last winter at the request of the Food Administration.

In general, as regards the program outlined above, other important measures of conservation will be effected as follows:

First—By the closing of plants or the consolidation of plants there will be rendered available skilled men who are vitally needed in the many war industries of this country. Provisions are now completed whereby men with such training will be assisted in obtaining profitable work suitable to their ability.

Second—In many parts of the country there exists at the present time a power shortage. The interconnection of systems, the diversity factor of these systems considered, will render available additional quantities of power. The Council of National Defense is examining all communities where there is a surplus of power, having in mind the possible establishment in such communities of industries.

It may be stated that the conservation efforts of the Fuel Administration along the above lines are being directed so as best to serve the interests of all with a minimum of inconvenience and cost and with the object of making the coal supply that is available go as far as possible, so as to prevent the necessity of further drastic measures such as those of January.

It will be patent to every reader that in the face of a great potential shortage it would be criminal for the Fuel Administration to neglect obvious means of fuel saving such as those outlined above and equally criminal for the individual plant owner to refuse or defer co-operation which may have as a direct result a loss in production of war materials or which may jeopardize the health of many families through shortage in coal supply. The administration believes it should not be necessary to resort to the issuing of orders for the adoption of these conservation measures, but is relying, as in the past, upon voluntary action by those concerned and does not wish to enforce the measures where the saving in fuel would result in hardship to the owners not commensurate with the public benefit.

In this spirit the Fuel Administration invites co-operation, whether the question be one of interconnection, of operating plants at maximum efficiency or of temporary closing down of plants. We invite suggestions and criticism of a constructive nature from all sources.

Government Depending on Utilities

At a district meeting of the Ohio Independent Telephone Association in Columbus President Frank L. Beam, Mount Vernon, advised members to ask for fair service rates and to give full publicity to their costs and expenditures, so that the public may know and understand the reasons for any addition to the rates that may be requested. The government and all its branches, he said, are depending upon public service companies to an almost unbelievable extent.

The Manufacturers and the Central Stations

Makers of Electrical Supplies Have a Very Direct Interest in the Growth of the Power Houses—War-Time Conditions Make Co-ordination of Effort and Standardization of Material More Important than Ever

MANUFACTURERS of electrical supplies are following with keen interest the great activities and rapid development of central stations under the pressure of war conditions. Their own operations are affected by the volume of business of central stations and the progress of these properties. However, the manufacturers of supplies meet also a large demand from other classes of customers, and at present one of the most important of these is due to the war necessities, direct or indirect.

Conditions at this time, as well as the prospective situation, are of such vital importance to different branches of the industry that A. W. Berresford, president of the Associated Manufacturers of Electrical Supplies and vice-president and general manager of the Cutler-Hammer Manufacturing Company, was asked to discuss them for the ELECTRICAL WORLD, with particular reference to the relation between the condition of the manufacturers and the central-station industry.

Demand on Central Stations and Their Response

Mr. Berresford spoke of the remarkable enlargement in the demand upon central stations for power and commented on the equally remarkable showing which the central stations had made in meeting this demand. He expressed the belief that this increase in power consumption was not along the lines which it would follow under normal conditions, but, on the contrary, was due to the abnormal expansion of industry in mechanical lines consequent on government demands, and that in all probability a larger portion of the increase was being employed for industrial application than is normally the case. This condition seemed to indicate large potentialities of growth for the future, in that after the war there would be a direct reduction in demand of this nature and a consequent excess in the production of power which the central stations must immediately seek to utilize by building up new sources of business. The amount of excess power available will naturally depend on local conditions, since certain of the industries will undoubtedly be able to maintain their present consumption in peaceful pursuits, but to assume the present rate of production and consequent consumption of power would be the reverse of conservative. The result will be the resumption on an actual scale by the central stations of solicitation of power contracts, the intensive development of household appliance sales and a campaign for business of all classes that can be handled profitably under the load conditions present and with the result of stimulating the demand for the necessary material and exercising a direct and expanding influence on the business of contractors, jobbers and manufacturers.

Mr. Berresford expressed the belief that there could be no better time for co-ordinating the various branches of the electrical industry and that the probable future requirements make it highly important that the interests of the different divisions be brought closely together so that co-operative action might be taken. He pointed out that the manufacturers, by reason of their three organizations and the bond of union established by the Electrical Manufacturers' Council, were in admirable position to co-operate and indicated that through the council, or through some similar agency, the various branches of the business could be brought into more intimate contact and the problems which are common receive the necessary consideration.

Standardization of Material

In the matter of standardization of material, in which the National Electric Light Association is interested, Mr. Berresford stated that the interest of the manufacturer was identical with that of the central station, the jobber and the contractor, and that much could be accomplished by co-ordination of effort. It should be understood, however, that no one element can effect the desired result and that the interest and the point of view of the actual user of the goods must be consulted. The standardization of a device implies the elimination of a number of forms to which the customer has become used and the substitution therefor (and in some cases at a disadvantage) of the ultimate form agreed upon. This can take place only as rapidly as the customer is willing to accept the change, and the goods can be offered to the customer only as rapidly as the manufacturing program and the condition of jobbers' and contractors' stocks permit.

He expressed his appreciation of the value of the suggestions made by the National Electric Light Association, but felt that more rapid progress would probably result if the association would refer direct to the manufacturer devices which it felt were most important for standardization and most amenable to such treatment, which process would not require detailed consideration from the National Electric Light Association beyond the compilation of the needs of its member companies. The manufacturer could then determine what was possible and could submit his conclusions to the standardization committee of the National Electric Light Association.

Manufacturers Ready to Co-operate

Mr. Berresford had no hesitation in stating that the Associated Manufacturers of Electrical Supplies would be glad to work toward a solution of the problems presented and expressed his confidence in the ability of that association to obtain careful consideration by experts of the particular devices under discussion and to arrange for the meeting of such experts with the National Electric Light Association committees interested, and he further expressed the belief that a similar co-operative attitude would be taken by the other manufacturers' associations. Mr. Berresford believed that, in spite of the depletion of forces due to military requirements, the present time would be an excellent one to take up this work. He felt that this

depletion was more than offset by the development of the manufacturing organizations toward co-operative consideration of questions of this nature.

In speaking of business conditions as they affect the manufacturers of electrical supplies, Mr. Berresford drew attention to the amount of material needed by the government to the production of which the plants and machinery of such manufacturers was suited and commented on the fact that up to the present the electrical manufacturer had, to a large extent, permitted the machine shop rather than the electrical shop to provide the bulk of this material. He insisted that from both the patriotic and economic standpoint it was incumbent on the electrical manufacturer to see that his due proportion of this work came to him, so that, while doing his duty as a citizen in the present crisis, he might still maintain his organization and cope with conditions which would arise on the cessation of hostilities.

The character and amount of such work which can be taken in each shop can be determined only by the individual manufacturer after a study of the conditions at home and in Washington, and the work can be obtained only by the intelligent expenditure of personal effort at Washington in the presentment of his facilities and claims. There are two facts which should not be overlooked by the manufacturer in considering this work and determining the minimum profit basis on which he can afford to accept it—namely, that for the bulk of this detail manufacture no financing is required except the buying of such minor additions to machinery as may be necessary, and that practically no additions to material inventory are involved. Furthermore, after a manufacturer has satisfactorily produced goods for the government, the tendency is to keep him at work, and even if a manufacturer fails to obtain a second contract immediately after completing the first one, he is still in favorable position on the records at Washington as having produced goods and as competent to handle more business.

Readers of the ELECTRICAL WORLD are familiar with the work of the General War Service Committee of the Electrical Manufacturing Industry, which is serving as a connecting link between the government and the different groups of electrical manufacturers, and whose particular function it is to place before the government the ability of the industry to produce material which is essential for the prosecution of the war.

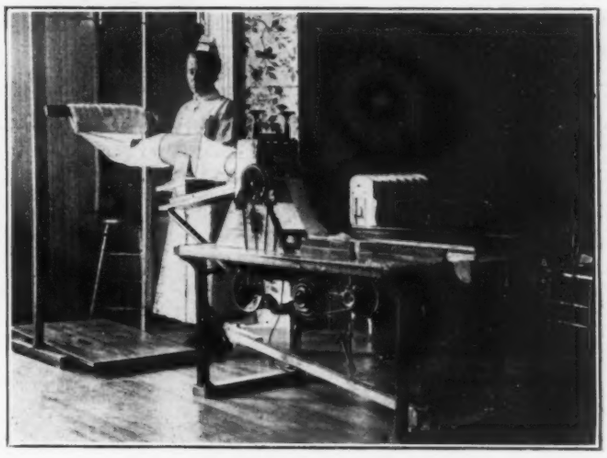
Mr. Berresford believed that the work of the war service committees should not be expected to take the place of an individual manufacturer's presentation to the government of his own capability. He felt that the best results could be obtained only by the personal effort of the manufacturer himself operating under the advice of the General War Committee.

Mr. Berresford furthermore expressed the belief that if the manufacturer did not follow the course indicated he would find that, while he might not be relegated to the class of non-essential industries, such percentage of his production in normal lines as was not needed at this time would in effect take this classification and that the influences which are being brought to bear must tend toward a corresponding diminution of production to the amount actually necessary and a consequent reduction of his organization and working force to the minimum required to make this production, whereas the prosperity of the country, as a whole, as well as the individual industry, demanded the operation of full capacity of all plants possible and is a fundamental in the maintenance of the morale of the people, our business position and our financial ability to make loans and pay taxes.

If the plants are maintained in operation, intelligent study will indicate the direction in which the character of the product can be shifted and this policy will prevent ruin of any industry. The government cannot afford, and does not desire, to interfere with the operations of any manufacturer beyond what is actually necessary to insure the output of war material. It can, however, only lay down general laws which shall govern, and it is the duty of the individual so to adapt his operations to these laws and the changed conditions as to maintain his condition of profitable operation substantially unimpaired.

Red Cross Bandage Output Increased Ten Times by Electricity

At the Boston (Mass.) workrooms of the New England surgical dressings committee a machine is now in service which has a capacity of 50 yards (45.7 m.) of gauze bandages per minute, an electric drive being a feature, as illustrated herewith. The machine was designed by J. A. Butler of the Industrial Service & Equipment Company, Boston, and easily will turn out ten times as much work as the usual staff of four persons can perform by hand. The machine will produce two sizes of folded bandages, one 4 in. (10.16 cm.) and one 3 in. (7.62 cm.) wide, and the number of cutters of dressing stock is varied to suit the convenience of the local workers. In operating the machine one worker feeds the material through the outfit and the others devote their time to cutting and packing. A Singer sewing-machine type motor of about 1/7-hp. rating, operated by 110-volt direct-current energy from the Boston Edison mains, runs the unit. The bandages are folded eight or four times as desired. Recently the Boston chapter of the Red Cross had a rush order of dressings to prepare, and the work was done on this machine in four days, 2000 5-yd. (4.5-m.) gauze rolls being made up. By hand the work would have taken at least three weeks with the local staff then available.



MAKING BANDAGES WITH ELECTRICITY'S AID

In League with the Government

How Central-Station Executives Are Assisting the Nation in Solving Local and National Problems and Safeguarding the Country's Electric Service Despite Handicaps

VARIOUS aspects of a central-station executive's war service, including the work of gas and electric utility representatives at Washington, were touched upon at a recent hearing before the Massachusetts Gas and Electric Light Commission by President C. L. Edgar of the Edison Electric Illuminating Company of Boston. In an informal way, Mr. Edgar outlined his own connection with the work. In August, 1916, he was appointed by Secretary Daniels an associate member of the Naval Consulting Board, and with others was asked to make an inventory of the manufacturing concerns of Massachusetts. This work was organized with C. H. Hodskinson of the Boston Edison company as secretary and treasurer and occupied about a year. All the manufacturing concerns in the State were communicated with, their machinery and products were listed and consideration was given to the possibilities in the way of changing over products in case of war. The work was done under the direction of N. S. Gifford, now manager of the Council of National Defense. When the latter organization went into effect the work Mr. Edgar and his associates had been doing for the Naval Consulting Board was automatically turned over to the Council, under Howard Coffin, who had charge of this class of work for the defense board.

C. L. EDGAR

War was then declared, and Mr. Coffin called into conference some of the leading men in the gas and electric utility fields, those of electrical affiliations from New England being Mr. Edgar and Henry G. Bradlee of the firm of Stone & Webster. By an informal vote Mr. Edgar was made chairman of the advisory committee, and at a later date the committee organized with offices in the Munsey Building, Washington. It has since been actively at work advising the government and has invariably refrained from anything commercial. In fact, Mr. Edgar pointed out, when the toluol situation came up and it was found that one or two of the commitee were interested in that product, they resigned, as they did not wish to embarrass the committee in any way. Before long the committee was drafted to assist F. S. Peabody, who was Dr. Garfield's predecessor as fuel administrator. The work of the committee increased to a point where additional assistance was needed, and this was furnished by the United Gas Improvement Company, Philadelphia, the New York Edison Company, the Philadelphia Electric Company and the Boston Edison company, Mr. Hodskinson being loaned by the last company for one or two months.

With the growing acuteness of the coal situation, the time came when it could not be handled by the routine purchasing department of the Boston company for its own service, and for two months Mr. Hodskinson devoted his entire attention to this question. James J. Storrow, federal Fuel Administrator for New England, has stated openly that Mr. Hodskinson helped him probably as much as anybody in Boston. The Boston company loaned 7000 tons of coal on one occasion to the Maine Central Railroad, when it was practically out of fuel, and kept the Boston City Hospital going for two days, all of this being due to the work done by Mr. Hodskinson at Washington and Newport News.

Later Mr. Edgar was appointed a consulting electrical engineer of the Bureau of Mines, Prof. L. P. Breckenridge of New Haven, Conn., being chairman of the committee of engineers which aids both the Bureau of Mines and the federal Fuel Administration. Mr. Edgar served on a committee which was asked by the War Department last winter to obtain 80,000 hp. in steam turbines for government nitrate-plant service, the necessary units finally being borrowed from the central stations of the country. Two months ago the government found it necessary to establish another war plant of 100,000 kw. for service in connection with the Du Pont interests, and Mr. Hodskinson was called into the case to assist in obtaining the necessary units. A 30,000-kw. unit ordered by the Boston Edison company and another ordered by the Boston Elevated Railway were taken over by the government. Others built later will replace them.

With regard to letting the Boston Edison generating unit go to the government, Mr. Edgar said: "I acquiesced, as far as we were concerned, because I thought the government officials were justified in taking it. I thought it was needed more by the government than by us."

Mr. Edgar has been almost every week in Washington for many months, doing work entirely outside that of the Edison company. This work has been almost entirely in consultation with other companies to see what could be done to help the government. D. S. Boyden, assistant to the electrical superintendent of the Boston Edison company, has been of much assistance to the New England Fuel Administration and has prepared various questionnaires for it. Mr. Edgar said that both he and Mr. Hodskinson were getting overwhelmed with war work, and accordingly Sidney Hosmer, head of the Boston Edison construction bureau, has been assigned to give his whole time to war service questions and has lately been in Washington for this purpose. Mr. Edgar is constantly being importuned along different lines for assistance, recently having been called up by telephone on a Sunday morning and asked to release a condensing unit to government service. The company did not give the turbine and condenser equipment outright to the government, but postponed deliveries, rearranging the orders with the manufacturers so that the material now being collected can be put into the machinery which the government needs for more important work, the central-station machinery to be put together a few months later. "I do not want to make a stump speech," said Mr. Edgar, "and am not going to do so, but I think I am justified in saying that 90 per cent of my thought the past year has not been with the Edison company but with the work of the government. I was told by my directors when the war started that I might have a year's leave of absence, but I thought I could do better service along the line in which I have been working. I thought I would be of more use to the community and to the country by dabbling in a lot of things, as I have, rather than by cutting loose and giving my entire time to one thing."

Mr. Edgar said he was in sympathy with what the government is doing relative to plant correlation and control, although in some cases it is difficult for the companies to accommodate their operations to meet the demands of the army officers in charge of the local situations, as at Niagara. Mr. Edgar stated that he proposed to play the government's game despite the handicaps which it may impose. All these activities bearing upon control of utility administration bear upon the question of regulation and support the company's general contention that the present is not the time to subject the companies to such a rate inquiry as is proposed in the Boston Edison case now before the commission. One of the problems to be discussed at the forthcoming Atlantic City Convention of the National Electric Light Association is the possibility of reducing some of the labor shortage of the central stations through rendering bills every two months. Other war problems will be discussed at this time, and Mr. Edgar said that at the next hearing he expected to make a more detailed statement bearing upon the company's contention that for the period of the war the rate inquiry should be suspended.

ENGLISH RESTRICTIONS ON ELECTRICAL PURCHASES

Applications to British Ministry of Munitions for Priority Certificates to Buy Apparatus Must Show Energy Supply Conditions

Applications to the British Ministry of Munitions for priority certificates to permit the purchase of motors and other electrical apparatus now have to be accompanied by a certificate from the chief engineer or manager of the public service undertaking concerned. This certificate is to state:

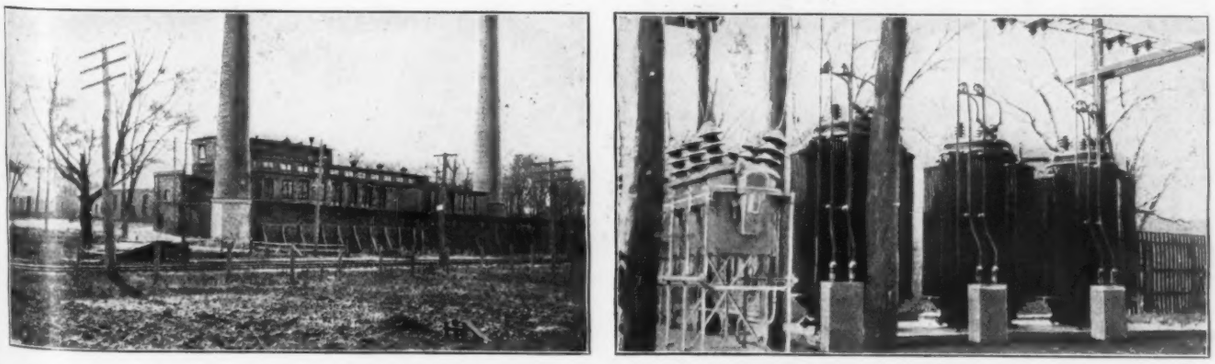
1. That adequate generating plant capacity is or is not available.
2. That no additional cost or material is involved in connecting the premises to the mains (including substation equipment, if any), or
3. Where expense is involved the material and apparatus to be provided and the cost thereof, and whether lead-covered cable is necessary or not. Where lead-covered cable is deemed necessary, the voltage of the current transmitted should be stated.

Applicants should, whenever possible, also obtain the written support of the government department interested in their manufactures, and forward a copy of same.

The purpose is to reduce the demand for energy—other than that used for urgent war purposes—supplied by the public service undertakings and the time occupied in making inquiries.

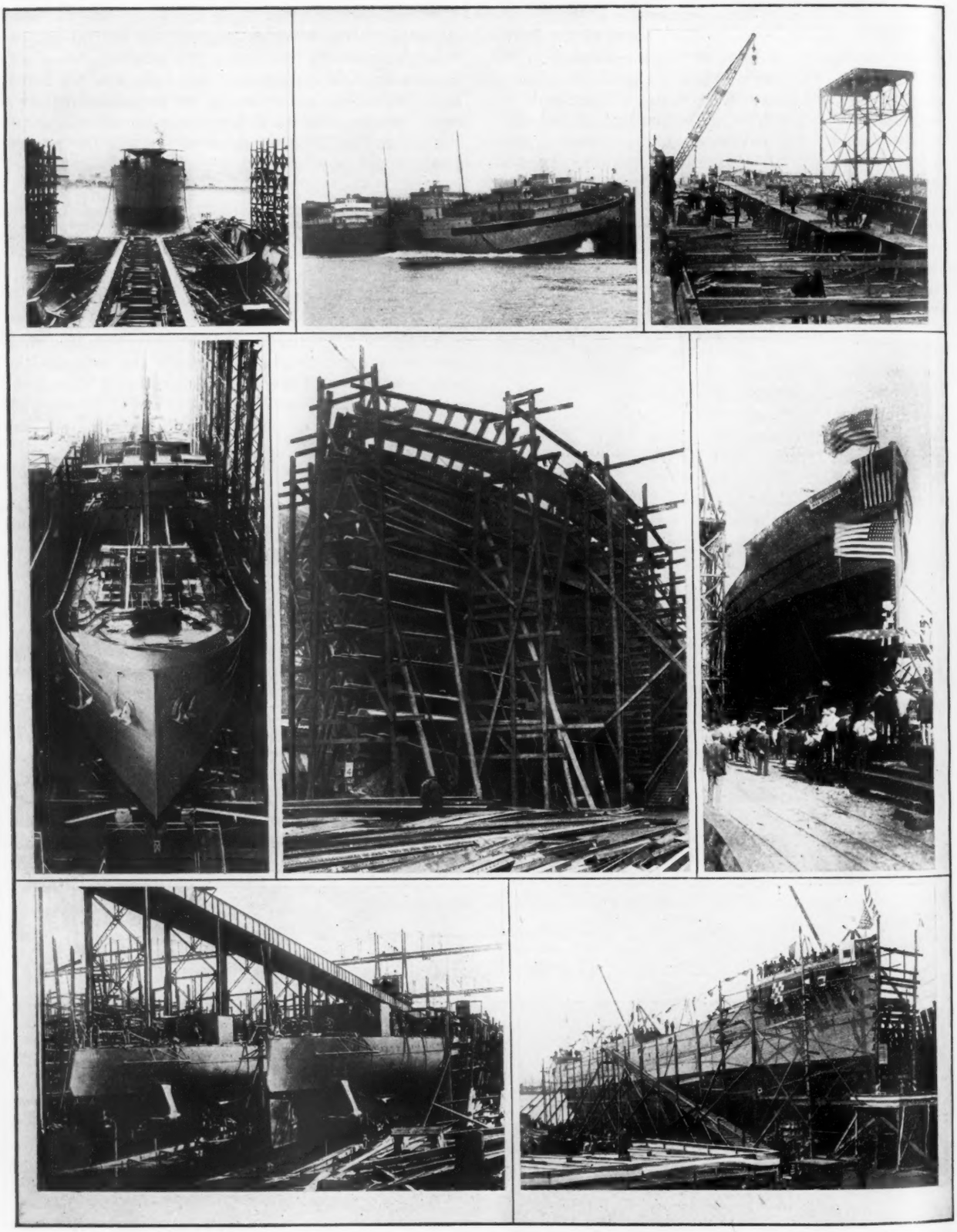
New restrictions relating to electric converter plant have also been issued by the British Ministry of Munitions. Applications under this order are to be made to the director of electric power supply in the Ministry of Munitions.

Backing Up the Fuel Administration



A 4000-kw. outdoor substation (at right) supersedes a 3364-kw. Attleboro (Mass.) steam plant (at left), saving fuel and a freight rate of 60 cents per ton on coal through interconnection with the Providence (R. I.) central station.

Ships Are as Important as Guns



The largest shipyard in the world fills all its power requirements from central-station sources, and so does the smallest. It matters not whether the ships are built of wood, concrete or steel, electricity is used in the erection of all.

What Commissions Are Doing on Rates

Action Taken by Various Public Service Commissions Regarding Increases Sought or Made on Account of Higher Operating Cost—Views as to Duration of High Expense Ratio

As the result of a survey of the broader aspects of tendencies of electric rates in the war crisis, the ELECTRICAL WORLD will present several articles. This, the first one, will be followed by others in later issues.

WAR problems have thrown a new and burdensome responsibility upon the public service commissions of the various states which have thorough regulative statutes.

Put into office by the public, intrusted with a clear obligation to both the consuming public and the supplying utilities and their security owners, these bodies face a critical test, if not a grave crisis, in the history of regulation. They hold great and unavoidable authority over the electric properties and the consumers in their relations toward each other. How they are exercising this authority, whether they have a full appreciation of the changing conditions due to the war, is of vital concern for the future of regulation.

Under the pre-war conditions the electric utilities followed generally the practice of reducing rates and building up large volume of output. Now that conditions of cost and demand are influenced powerfully by war requirements, many utilities find that a partial reversal of practice is necessary to preserve their financial integrity unimpaired.

That the commissions are alert to the possibilities of the altered economic situation is shown by replies to inquiries made by the ELECTRICAL WORLD. They want to know the facts and apparently they are not unwilling to regulate rates upward when the facts so justify.

How Wisconsin Decides

Among the state commissions the deliberations and conclusions of the Railroad Commission of Wisconsin have been followed with care from the beginning because of the standing of the men who have composed its membership and its staff.

Harold L. Geisse, the secretary, writes to the ELECTRICAL WORLD:

"We have authorized a number of electric utilities to increase rates for limited periods subject to review by the commission at any time, on account of the showing of increased cost of operation. In connection with this, however, it should be said that the commission does not consider the increased cost of operation in and of itself as a justification for increasing rates. The application in each of these cases is judged with reference to the extent of the emergency which has been caused by the increased expenses, and if an emergency does not exist, or if the conditions of the utility for years past has been so good that it can be expected to carry a part of the burden for a time, the commission would not be disposed to authorize emergency relief. This would not in any way, of course, prevent the utility from bringing a case in the regular order of events, not under the emergency statute.

"In some cases the rate increase has been applied to all classes of customers, and in others to only such classes as were receiving the lower rate and in whose rate the coal component was a relatively large part.

"The number of applications has not been large. An increase was granted:

"To the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company of 0.31 cent per kilowatt-hour for all energy above 1000 kw-hr. per month.

"To the Eastern Wisconsin Electric Company, Sheboygan, 0.25 cent per kilowatt-hour for all energy except the general lighting.

"To the Eastern Wisconsin Electric Company at Fond du Lac, 0.5 cent per kilowatt-hour for all service.

"To the Wisconsin Traction, Light, Heat & Power Company at Appleton, Neenah and Menasha an increase was granted which had the effect of eliminating all energy steps of less than 8 mills.

"There have been one or two other minor increases in the case of small plants.

"Not many of the electric utilities have as yet filed applications for authority to increase rates, although those acted upon involved some of the larger companies in the State.

"We have been proceeding in the hope that the abnormal condition would be corrected, and accordingly have granted increases only for limited periods. However, it seems to us very doubtful if these conditions will actually be corrected to anything near normal for at least several years."

Coal the Dominant Factor in Massachusetts

The Massachusetts Gas and Electric Light Commission has had to take no action upon electrical rate increases since last summer, first, because no rates fixed by the board have so far been increased; second, because no statutory complaint of the actual increases put into effect by electrical utilities has been received. In the absence of these causes for investigation and decision, rates established by utilities go into effect without review by the commission in any formal way.

About forty announcements of increases have been received from electric utilities or gas companies' electrical departments and twelve from municipal plants. Almost all of these have been increases in power rates. A careful study of the titles of these announcements of increase, as summarized by the commission's office, shows that the most general increase is about 0.5 cent per kilowatt-hour on power rates ranging say from 4 to 6 cents, and that a rough approximation of these increases would be about 10 per cent.

No exact average can be deduced from the tariffs filed, however, as in some cases the discounts are altered; in others the blocks of energy at stated rates have been changed; in others minute fractions of a dollar represent the advance in energy price corresponding to changes in the price of coal, and, again, certain special rates, like window lighting and flat-rate residence lighting, have been modified or abolished. In some cases the power rate increase is as low as 5 per cent. Very little evidence of organized opposition to the

electric rate increases appears to have materialized.

One advance in lighting rate, from 8 cents net to 8.5 cents per kilowatt-hour (Seekonk), is reported, but so far the commercial lighting rates have been practically untouched.

About ninety-three electrical utilities are under the supervision of the board, and from 40 to 50 per cent of these have established some electrical rate change calculated to yield increased revenue to the company.

Present conditions affecting rates appear to be largely in the nature of a war emergency, with the increased cost of coal a dominant factor therein.

What Michigan Thinks of Costs

Cassius L. Glasgow, chairman Michigan Railroad Commission, writes:

"Most of the utilities in this State are operating under franchises granted by the municipality in which they are located and which control the rate. In two or three instances complaints have come to this department, and we have recommended that they be taken up with the local authorities to see if an adjustment could not be made, even temporarily, during the war.

"In one instance a village has made complaint to this department and hearing has been had thereon, and the public utility has been permitted to charge an increased rate both for private and public lighting and to add power service. This has not been limited to the duration of tne war owing to the fact that a reconsideration of this rate may be had at any time upon the application of either party.

"It is our opinion that the things which contribute to the expense of operating public utilities will never so decrease in price as to permit them to operate under the old schedules successfully. However, we believe, where during the duration of the war they have been permitted to name a rate which would produce a reasonable return based upon present expense of operation, that when after the war these expenses will somewhat decrease, naturally the public will demand a like reduction in the rates."

Seventy Pennsylvania Companies Act

H. E. Ehlers, chief of Bureau of Rates and Tariffs, Public Service Commission of Pennsylvania, says:

"It is not the practice for utilities in this State to make application for increases in rates, as the public service company law provides that changes in rates may be made by the filing, publishing and posting of the changes, giving thirty days' notice, when the changed rates automatically become effective on the effective date fixed. Such rates are at all times subject to investigation upon complaint.

"For your information I wish to state that approximately seventy companies have filed increases in rates to become effective this year. A number of the increases have been filed as effective for one year, or during the period of the war."

Status of Cases in Virginia

Alexander Forward, commissioner of the State Corporation Commission of Virginia, writes:

"Necessary increases in cost of operation are considered favorably, and it may be in some cases entirely, for the purpose of authorizing increased rates.

"In regard to what classes of rates are increased, this would depend largely upon the relationship of rates between the different classes, but in most of the cases recently passed upon by us all rates of the electric utility were revised.

"We have approved increases in some seven or eight instances during the past year, have not rejected any applications relating to electricity and have two cases now pending.

"Our records show that forty-nine utilities of this character operate in this State, so that at present only about 4 per cent of them now seek higher rates.

"In regard to the present general conditions, particularly as to operating costs affecting electric utilities, we feel that this condition is temporary, and in authorizing increased rates, unless cause is shown to the contrary, it is our custom to limit the increased rates so as to expire on some future date, subject, however, to further hearing at some later time."

How Rhode Island Views Conditions

From information obtained by a representative of the Electrical World from the Public Utilities Commission of Rhode Island the following is stated:

Increased cost of operation of course would be a factor in the determination of the commission in case exhaustive rate proceedings were instituted; but no formal hearings have been required of late for the reason that there has been no statutory opposition to the increases effected.

It may be assumed that the commission would not approve any grossly discriminating increases in class rates, its policy being rather to permit such generally fair advances as are justified by the present conditions. A particular rate may be altered, as in the institution of the minimum charge on residence lighting installations lately placed in effect in Providence, but this does not mean that the other consumers were penalized.

In general, the electric companies informed the commission in making recent advances that they expect to meet about half the increased cost themselves through more efficient operation, looking to the consumer to bear the other half of the increased costs in the shape of higher rates.

About twelve schedules of rate advance have been received and allowed during the last six or eight months. Very roughly, it may be said that the advance in power rates is of the order of 20 to 25 per cent, and in lighting rates in the vicinity of 10 per cent. In Rhode Island, both power and lighting rates have advanced synchronously. No proposed advances have been rejected and none are now pending.

Practically 100 per cent of the electric utilities under the supervision of the commission have sought increases and obtained them. Owing to centralized management some of these schedules have been filed and put into effect by groups, as in the utilities controlled and operated by the Narragansett Electric Lighting Company and the Stone & Webster organization. The companies have worked in harmony with the local authorities and publics, showing them the need of an increase, and the public has generally appreciated the situation.

It is the view of the commission's chairman, W. C. Bliss, that the present operating costs and conditions of electrical utilities are in considerable degree of an emergency character, but it is not expected that there will be a rapid return to former levels of cost at the close of the war as regard coal and labor expense.

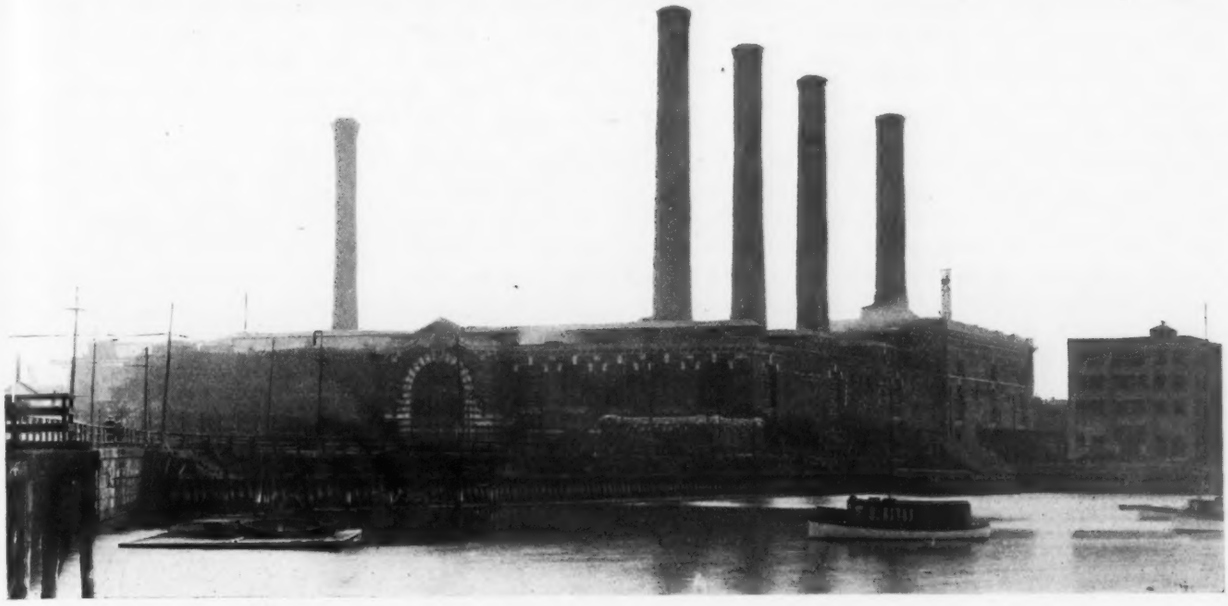


FIG. 1—105,000-KW. L STREET STATION OF THE BOSTON EDISON COMPANY, WHICH WOULD BE INVOLVED IN INTERCONNECTION

Benefits Possible from Interconnection

Analysis of Conditions in Eastern Massachusetts—Possibilities of Higher Efficiency, Reduced Investment and Operating Expenses per Rated Kilowatt, and Releasing Equipment for New Business

FIFTY thousand kilowatts in plant equipment can be released on central-station systems north and south of Boston, Mass., by a comprehensive development of the interconnection plan, according to L. L. Elden, electrical superintendent of the Edison Electric Illuminating Company of Boston, who addressed the New England Central Station Power Engineers' Association recently. It is estimated that this benefit could be realized within a few months, so far as the engineering side of it goes, and with an outside expenditure of about $2,750,000. The improvement in load factors in the local plants would result in greatly increased efficiency of operation, permitting the less economical stations to be shut down for at least a large part of the year and saving coal on a substantial scale.

Mr. Elden's conclusions have been reached as the result of personal studies of the load conditions in the eastern Massachusetts district and his knowledge of the benefits of interconnection as developed in various parts of the country.

Prior to 1914 most interconnections were between plants under the same management or control, the objects being to secure greater efficiency and to conserve reserve capacity. One of the best examples of interconnection is the system of the Pacific Gas & Electric Company, in which steam and hydroelectric plants are operated jointly and with maximum efficiency. It is estimated that about double the present investment would be required if the plants now tied together in this system were not operated under a single control. Other important interconnected systems are operated by the Southern Power Company and the Mississippi River Power Company. In the Montreal district five large companies are operating steam and hydroelectric plants under one control and with marked advantages. The New England Power Company and the Turners Falls Power & Electric Company are interconnected in New England with good results, and the Public Service Corporation of New Jersey is planning a transmission trunk line of state-long dimensions, into which seven or eight large steam plants will feed, reducing independent reserve capacity and saving fuel. The government is planning to build a large plant at the mouth of the mine in Pennsylvania for transmission of electricity to munition plants in the Philadelphia and New Jersey districts.

BETTER LOAD FACTOR IS ONE BENEFIT

An improvement in load factor generally follows interconnection. The more economical plants can be operated at their maximum efficiencies, reducing costs and investment charges and giving a better diversity factor. Thus, 10,000 kw. can be sold out of the combined reserve of two plants with the following characteristics when interconnected: Plant A, five 10,000-kw. units, maximum load 40,000 kw., spare capacity 10,000 kw.; Plant B, three 10,000-kw. units, maximum load 20,000 kw., reserve capacity 10,000 kw. Interconnection gives a constant reserve of 10,000 kw. for whichever plant requires it, safeguarding the service of each plant as well as before, since coincident peaks are not likely to occur. The combination of 80,000 kw. capacity in two adjacent interconnected plants may easily give an available excess capacity of 25,000 kw., a difference of ten or fifteen minutes in the peaks being sufficient to release this maximum capacity. In such a case 10,000 kw. can be held in reserve and 15,000 kw. sold for new business. The percentage of spare capacity is larger in

smaller plants and the benefits of interconnection are great even in stations of very moderate size.

NEW ENGLAND INTERCONNECTION OPPORTUNITIES

Within the last eighteen months considerable work in tie-line construction has been done in Massachusetts. The Malden-Salem-Revere line (described in the ELECTRICAL WORLD of Sept. 1, 1917) is giving excellent service, and there will shortly go into operation a tie line between the Revere plant of the Suburban Gas & Electric Company and the Edison Electric Illuminating Company of Boston, with a capacity of 3000 kw. There is now under consideration by the New England Power Company the construction of a 66,000-volt transmission interchange line to extend from some suitable point to the L Street station of the Boston Edison company, in South Boston. The capacity of this line would be at least 20,000 kw., and the route is now under investigation. The Edison system is connected with the hydroelectric installation of the Metropolitan Water and Sewerage Board at Sudbury, Mass., and soon will be connected with the New England Power Company's system by a line of 10,000 kw. ultimate capacity running between the Sudbury plant and the Clinton station of the water board.

Convenience and economy of service are no longer the controlling reasons for interconnection. The demands of the government for electrical service, the difficulties of obtaining coal, the long deliveries now in effect on electrical equipment and the importance of conserving reserve capacity are most influential. The government has taken possession of the second 30,000 kw. turbo-generating unit ordered by the Boston Edison company for its L Street station extension, on the ground that the federal authorities have a more immediate and pressing use for this machine than its purchaser.

About eighteen months ago Mr. Elden made a comprehensive study of the possibilities of interconnecting the principal central-station systems north and south of Boston, tying these into the Edison system, and it is known that the ratios obtained prevail to-day. An outline of the investigation made by Mr. Elden is accordingly presented.

The plan involves, on the south of Boston, the establishment of a trunk line interconnecting the Boston Edison plant on tidewater at L Street, South Boston, with various local generating plants through appropriate taps or branches. In 1916 the capacity of the local central stations in the general southern Massachusetts area was about 50,000 kw. and the sum of the peak loads was about 40,000 kw. Owing to the non-coincidence of peaks, there would be a total spare capacity of 20,000 kw. through interconnection, excluding any tie line to the Boston Edison station and plants serving traction lines in the districts reached by the trunk line. All these central stations were developing about 70,000,000 kw.-hr. per year, the average coal consumption being 2.84 lb. (1.28 kg.) and the range from 2.27 lb. to 6.4 lb. (1.25 kg. to 2.88 kg.). Assuming an average of 2 lb. (0.9 kg.) per kilowatt-hour, which could be attained by the improvement of station load factors resulting from interconnection, 28,000 tons of coal could be saved in a year by interconnection, and at $8 per ton this would represent an annual saving of about $225,000. On the basis of $80 per kilowatt, the saving in capacity resulting from interconnection would represent $1,600,000, which would thus be available for handling additional service as required.

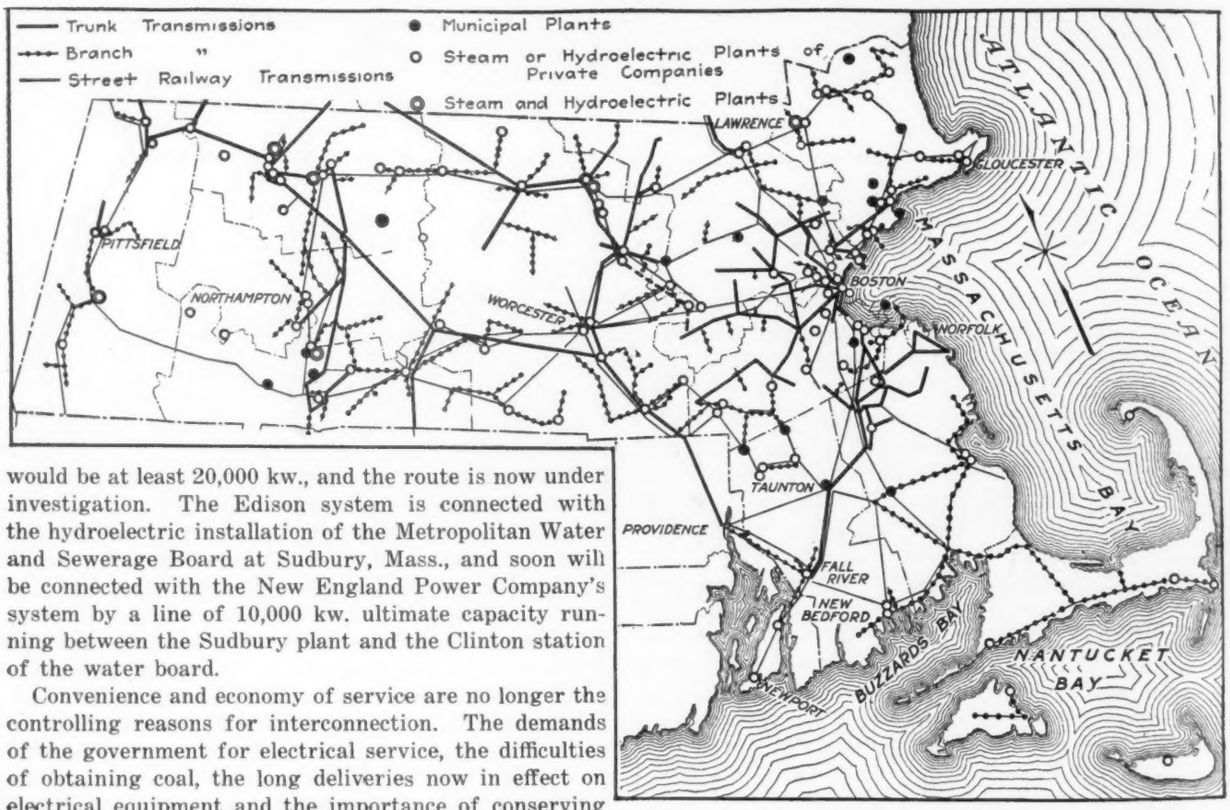


FIG. 2—INTERCONNECTIONS IN MASSACHUSETTS THAT ARE RELEASING EQUIPMENT FOR NEW BUSINESS

If existing rights-of-way could be utilized in connection with this plan, which seems probable, the cost of such line construction or reconstruction as might be required, including local substation work, would probably not exceed $1,250,000. The principal source of delay would be in obtaining the substation equipment needed for comprehensive development. Allowing fixed charges on this work at 15 per cent, there would be a saving of at least $75,000 in fuel alone, entirely ignoring labor economies. It appears that at least six plants could be shut down in the local territory a part of the year, and the bulk of the load would be handled by the larger and more efficient interconnected stations. The 1918 output of the stations in the area under consideration is estimated at about 100,000,000

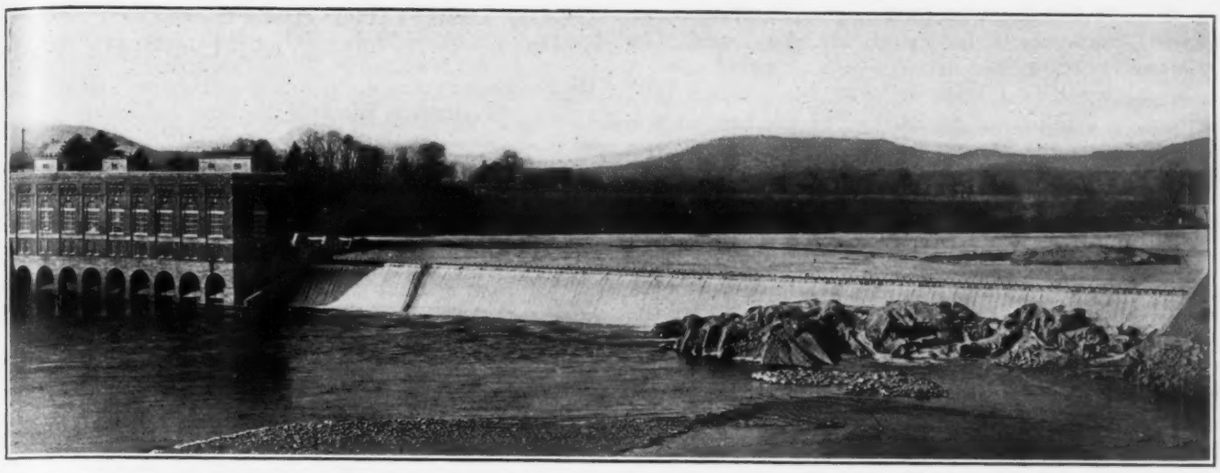
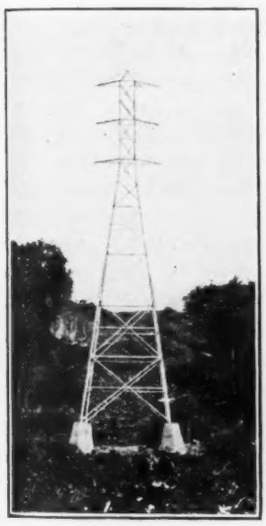


FIG. 3—20,000-KW. VERNON CENTRAL STATION, NEW ENGLAND POWER COMPANY, ON CONNECTICUT RIVER



FIGS. 4 AND 5—TRANSMISSION-LINE TOWER, EASTERN MASSACHUSETTS ELECTRIC COMPANY, AND DISPATCHING HEADQUARTERS, NEW ENGLAND POWER COMPANY

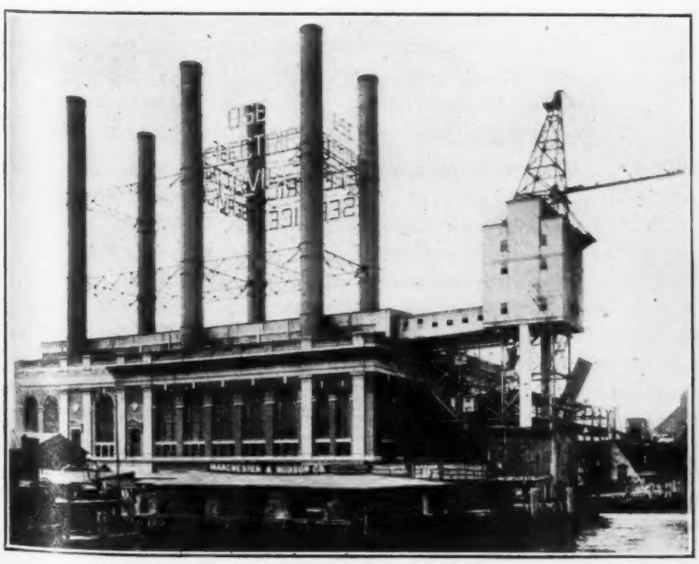


FIG. 6—NARRAGANSETT ELECTRIC LIGHTING COMPANY'S 80,500-KW. PROVIDENCE STATION

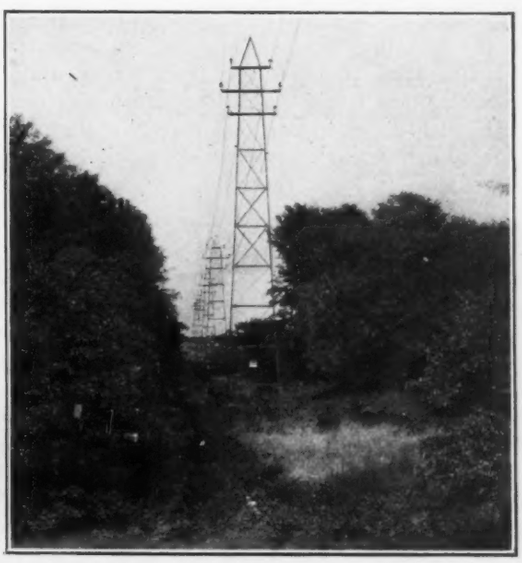


FIG. 7—INTERCONNECTION LINE RUNNING NORTH OF THE CITY OF BOSTON

kw.-hr., and the financial return on such an interconnection plan would be far better, Mr. Elden said, than on many electric power developments proposed.

On the north of Boston, in 1916, there was a total generating capacity of 84,000 kw. in the central stations between the Boston system and southern New Hampshire. The combined peak loads were 58,000 kw. The average coal consumption was 3.09 lb. (1.39 kg.) per kilowatt-hour, and by interconnection it is estimated that a saving of 42,000 tons of coal could be realized per year. The construction cost of the necessary trunk tie line would be about $1,500,000 at the outside. The fixed charges and upkeep of the line, at 10 to 12 per cent, would not exceed $150,000 to $180,000 annually, and at $8 per ton the coal saving would be double this amount. The interconnection would presumably include about sixteen stations. The coal consumption of a representative group of these ranged in 1916 from 2.69 lb. to 13.34 lb. (1.21 kg. to 6 kg.) per kilowatt-hour. At least six plants probably could be discontinued, and for eight months of the year half a dozen or thereabouts of the larger plants would handle the load. The value in generating capacity rendered available for other purposes through interconnection is estimated at $2,400,000, or about 30,000 kw.

The entire interconnection plan, it is estimated, would therefore save at least 50,000 kw., representing an investment of about $4,000,000 and an annual reduction of coal consumption amounting to at least 70,000 tons. A conference between engineering and legal representatives of the various companies should be able to arrange equitable terms of financial interest and the operating arrangements would be comprehensive and not over-difficult. The cost of the new construction might be met by pooling of company interests, but probably a more satisfactory method would be by the formation of a company to handle the interconnection program, each company then contributing to a sinking fund a proportion of its savings based upon its kilowatt-hour output. With coal at $5 to $6 per ton the investment could be wiped out in less than ten years and all the differences between fuel at these prices and at from $6 to $8 per ton would be compensated for by the larger output of the systems grouped about the tie line. A single-circuit tie line would meet the conditions in view of the fact that the associated plants would feed into this line from the ends and from intermediate points. Finally, there would result from such interconnection, with scientific operation, not merely coal saving but a reduced generating cost which ultimately might properly be reflected in lower rates for electric service.

New Headquarters Offices for New England Power Company

The New England Power Company has begun the erection of a new headquarters office building at 35 Harvard Street, Worcester, Mass., to replace the building destroyed by fire in March. It will have a frontage of 42 ft. and a depth of 70 ft. and will be of brick construction. The general offices will be on the first floor, and executive offices, drafting and engineering rooms will occupy a second story. There will be a repair shop in the basement. The temporary office of the company is at 26 Howard Street. S. C. Moore is general manager.

GOOD LIGHTING HELPS IN WINNING THE WAR

By Decreasing Accidents and Spoilage and Increasing Production Electric Lighting Is Doing Its Part to Hasten Victory

MUCH has been written concerning the tremendous value of electricity in the successful prosecution of the war, and almost always, when linked up with the central station, it has been the electric motor that was referred to. To be sure, the application of electric power to America's industries has made it possible to continue production in many plants and to augment greatly the output in others.

However, though perhaps less apparent, yet the lighting of a plant is none the less important. In no small measure have the Allied armies in Europe been able to put up such a good fight because of the quality of electric light in the munition and allied plants. Guns, ammunition, food, clothing and all the other necessities for our fighting forces are needed in quantities. Quantity production in this sense means maximum production, and this means working day and night. Light, therefore, and good light, is a necessary adjunct of our army and navy.

With this thought in mind, the ELECTRICAL WORLD canvassed a large number of the leading manufacturing and industrial plants in the United States in order to show as concretely as possible the value of good lighting. In all of the plants electric light in one form or another is employed. In a majority of the reports it was stated that new lighting systems had recently been installed, and in not a few cases it was stated that different forms of lighting were continually being tried out in order to get the best artificial lighting arrangement possible. It was particularly noticeable that manufacturers are changing from the inefficient carbon lamp to the tungsten lamp, and particularly the gas-filled unit.

Another frequent change noticed was from arc lamps to tungsten incandescent lamps. There were also a number of instances of change from mercury-arc to tungsten lamps.

The reports showed a disposition to depart from the use of bare lamps, and in quite a few cases it was reported that lamp candlepower was considerably increased. Instances were also noticed of changes from clusters to single lamps.

BETTER SPIRIT OF LABOR WITH GOOD LIGHTING

Manufacturers were asked in cases where changes in lighting had been made whether there was any noticeable effect on the workmen. In most cases no effect was noticed, but this cannot be taken at its face value. Manufacturers generally are sold on the benefits of good lighting and do not take the trouble to investigate the effects for the sellers. In a large number of instances, however, it was noticed that the workmen showed a better spirit and went at their work in a happier frame of mind when the lighting conditions were improved. The efficiency of employees was also better.

One factory making molded insulation on changing from carbon and arc lamps to tungsten and gas-filled lamps with reflectors noticed an increased output on the benches of 75 per cent. A sugar mill changing from carbon to tungsten lamps with reflectors noticed an in-

crease in output of the night shift of 20 per cent, besides eliminating bad batches of sugar.

The great value of lighting to-day is its effect upon labor and therefore upon output both in quality and quantity. In this connection a superintendent of one of the largest explosives plants in the United States said to the ELECTRICAL WORLD:

"Since in our munition plants we are operating night and day, the question of lighting is an important one. In fact, one must have good lighting in order to keep up our production, avoid accidents and produce better esprit de corps."

Labor to-day, notwithstanding statements by organized labor to the contrary, is very scarce, and, what is more, the indications are that it will be worse before it gets better. There are any number of shops suffering from labor insufficiency—shops where every minute of occupied labor counts in the production of necessities.

Consequently the element of man-hours assumes an importance not previously known. An accident, with the resulting loss in time by one or more operators injured, is no longer a dollars and cents proposition but rather one of output—the output of goods so sorely needed by the nation and its allies. Besides, when an accident occurs it is not only the injured who lose time. The psychological effect on the other workers is such that considerable time is lost and a large part of the day's output of those near the accident is lost through spoilage due to nervousness.

ACCIDENTS DECREASED

It is apparent, therefore, that anything tending to decrease industrial accidents has a very real value in helping to win the war. That lighting is in the category of an accident preventer is evident from the replies received by the ELECTRICAL WORLD in its canvass.

In one plant a new system of lighting so reduced the number of accidents that the company decided to carry its own insurance. A company engaged in the manufacture of zinc concentrates states:

"We have a remarkably small number of accidents, although more than 1000 men are employed. We attribute part of this to adequate lighting, which is in line with the safety first idea."

A leather manufacturer states: "Improved lighting naturally lessens accidents, particularly around elevators and machinery."

A statement from a plant milling low-grade copper is to the effect that "Light exposes danger. Good lighting is insurance against accidents."

Another copper-concentrate plant says: "We believe that better lighting has done its share in reducing our accidents more than 50 per cent."

Not only does better lighting prevent much of the loss of time resulting from accidents but also that resulting from poor health. With good and adequate lighting it is possible to keep the plant cleaner and more sanitary and to reduce eye strain and headache.

That good lighting helps to build up esprit de corps seems undebatable. The men are happier, take more pride in their work and in the appearance of the shop, and generally do better all around when the light is good. It also undoubtedly has its effect on keeping labor turnover from going higher. It is very doubtful if a few cents more wages will tempt skilled men from a plant that is well lighted to one that is poorly lighted.

PRODUCTION INCREASED AND SPOILAGE REDUCED

There seemed to be a unanimity of opinion regarding the part good light plays in increased production, although there were no figures to substantiate the opinion. However, it had been noticed in many plants that the men start work more promptly in the mornings and work up nearer to quitting time. Less loafing has been noticed in plants that have installed better artificial lighting. As one manufacturer put it, "A poorly lighted mill makes the men sleepy and production suffers." One or two others instanced men going to sleep in dark places where the lighting was poor. In each case, however, this practice was eliminated by the installation of a better lighting system.

Spoilage and repairs are elements to be considered in any production program. The reduction of the former has a twofold significance to-day. It reduces production and also reduces the available amount of raw materials. Anything, therefore, which tends to lessen spoilage has a place in the war program.

Manufacturers seem unanimous in expressing their convictions that better artificial lighting means less spoilage. A statement from a copper mill is to the effect that good lighting "is a necessity in cutting out excessive waste of copper through the tails." A manufacturer of glazed kid states that better lighting has "lessened to a considerable amount the number of mistakes."

Another angle is brought out by the general manager of a rubber plant who states that good lighting "helps the inspection department to throw out more bad pieces which otherwise would get shipped to customers to send back." The other side of this situation is, of course, the lessening of the burden on transportation systems by just so much.

A manufacturer of motors points out that good lighting reduces spoilage very much where the workman is working to micrometer dimensions.

A sugar-mill operator states that "good lighting reduces spoilage to a minimum in our case. It used to be quite a frequent occurrence to add cane juice to the ocean brine because of the overfilling and consequent overflowing of juice tanks, a thing that has been reduced through better lighting to practically nothing. The splashing and spilling of the massecuite about the centrifugal driers has been reduced to a minimum, thus making for less spoilage and a cleaner plant. While exact figures of the saving thus brought about cannot be given, it is safe to say that the saving pays for the whole lighting system in one season. The saving in lubricants due to the reduction of spillage amounts to 25 per cent."

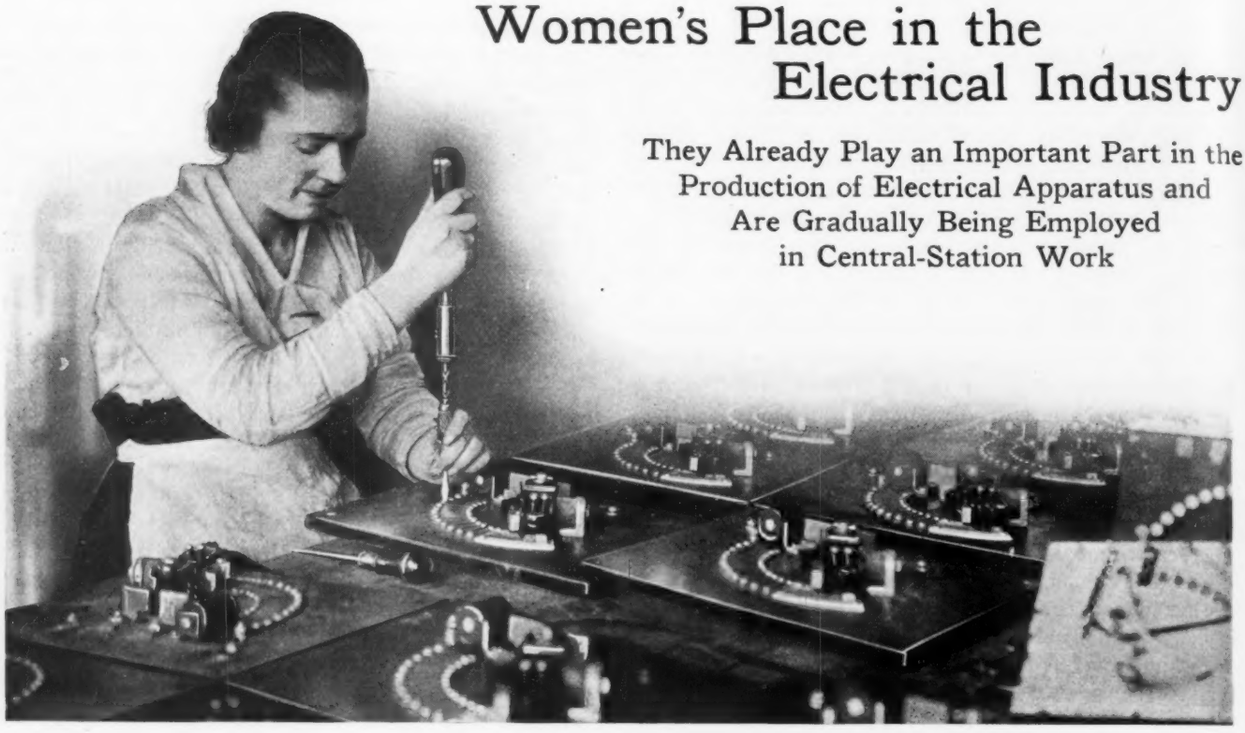
A tire manufacturer states that unless lighting for inspection is of the best tires that should be rejected for defects are passed up.

In a number of cases the value of good lighting in making repairs was mentioned. Mention was also made of the fact that good lighting made it possible to catch irregularities in a machine operation sooner than would otherwise be the case.

There is a unanimity of opinion therefore among manufacturers on the value of good artificial lighting. That it is playing a by no means insignificant rôle in winning the war is evident. The results of better lighting can be seen in increased output, fewer accidents, reduced spoilage and steadier labor.

Women's Place in the Electrical Industry

They Already Play an Important Part in the Production of Electrical Apparatus and Are Gradually Being Employed in Central-Station Work



FOURTEEN months ago almost to a day the United States entered the great world war. In that short time American industry has come to experience many radical changes. The change of greatest importance perhaps, because of the influence that it will have on human progress long after the war is over, is the utilization of that which is at hand in place of that curtailed or shut off by the war. Substitutes have been found that frequently give better results than the materials formerly employed.

Not only has substitution been made use of in the matter of raw materials but also in the labor that fabricates these raw materials into the finished product. The draft and the enlistments into the army and navy and other government work have taken millions of men out of regular employment. Industries new to this nation, such as shipbuilding and munitions manufacture, have drawn on the labor supply for hundreds of thousands of others. In addition, conditions brought about by the war have caused the manufacturing plants to increase considerably in number, facilities for production and output.

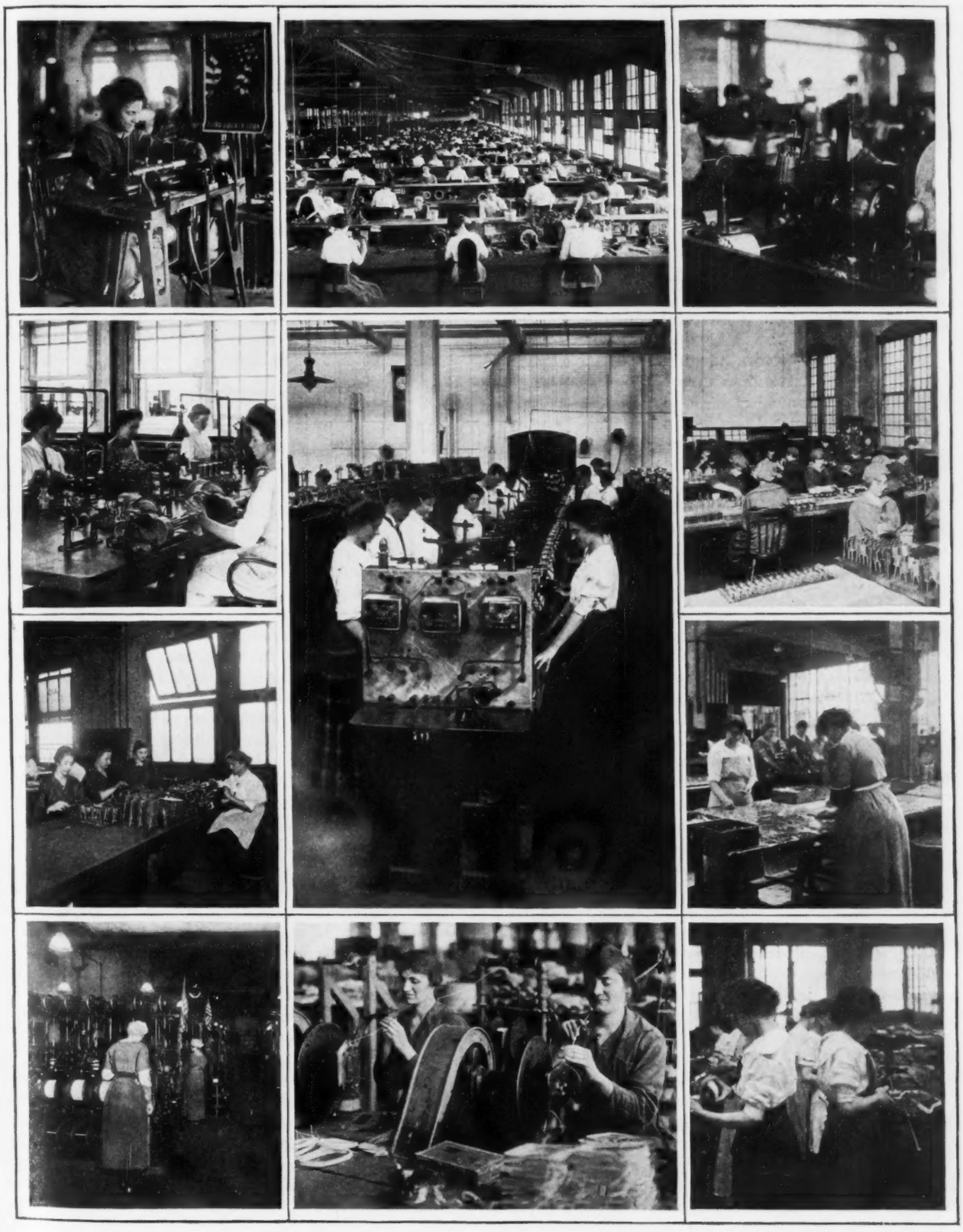
The demands of the war and of industry have therefore placed an unprecedented strain on the labor supply. Nor could this strain be relieved by the importation of labor from abroad. The war had virtually shut off our former supply of unskilled immigrant labor. Europe, however, with its experience gained through the three years of war prior to the entrance of the United States into the conflict had found a solution—woman. While the employment of women in industry was no new idea to American business men—history shows that women were employed in winding magnets as early as 1862 and that the Western Electric Company began employing women for coil winding in 1873—still industrial managers were reluctant to introduce women into factories on work formerly done by men. This has been in spite of the published records of English producers showing the quantity and quality of woman's work.

Nevertheless, the problem of a deficiency of male labor faces the nation. As the war progresses this situation naturally will become more acute. The government through its most recent draft proclamation of "work or fight" recognizes the need for more men in industry. This is the true situation in spite of frequent statements emanating from organized labor that there is no scarcity of male labor.

Recognizing that an insufficiency of male labor does exist and that as a result female labor must be substituted more and more, a representative of the ELECTRICAL WORLD has in the past two months made a personal investigation of the employment of women in a number of electrical manufacturing establishments. This study has been made in order that the entire industry might have an analysis of the experience of the plants visited.

While it was manifestly impossible to visit every electrical manufacturing organization, nevertheless, the products of the factories in which the investigation took place represent almost the entire line of electrical materials now on the market. The products include motors, generators, transformers, control appartus, meters and instruments, fans, lamps, wire and cable, insulation of many kinds, molded and porcelain insulators, storage batteries, ball bearings, turbines, all kinds of wiring devices, high and low tension protective equipment, lamp guards, switch boxes, panelboards and other standard electrical equipment.

In much of this work, of course, women have practically always been employed. Lamp manufacture, for instance, employs, roughly speaking, 80 per cent female labor. Coil winding has largely been done for years by women. A considerable part of meter manufacture and assembly has been done by women, although the last few months has seen more of the operation in



NUMBERS OF WOMEN ARE NOW EMPLOYED IN THE MANUFACTURE OF ELECTRICAL GOODS

Reading left to right, the pictures show the following operations: Winding rheostat coils; motor-coil winding; armature winding; meter armature winding; testing meters; lacquering switch parts; knife-switch assembly; mica building; wire braiding; making field coils; coil taping. In all of these operations women are now giving satisfactory service, and their field of employment continues to grow.

meter manufacture done by women than formerly. Much of the small work in wiring device fabrication has been done by women.

How Employment of Women Is Growing

Since about September last, when the first draft was called, all of the plants visited, with two exceptions, have begun in a small way, increasing gradually, to employ women in what was formerly considered as man's work. In one of the exceptions the management of the plant, being unwilling to employ women, turned in its necessity to old men—men who formerly, because of their years and infirmities, would have no place in factory production. The results in this case have been very gratifying to the management of the plant.

In very few cases have women been employed to take the places left vacant by experienced men. In the majority of cases women have replaced young men and boys. In many instances employers said that they had had this change in mind for a long time and that the war simply hastened their action. Much of the work is described as really woman's work—it is small, light and of quantity nature and by no means physically fatiguing.

Women have replaced male labor at the present time for the sole reason that it was impossible to obtain male labor in sufficient quantities and at the wages offered. The writer has one instance in mind where a boy yet to have his first shave entered the employment department of a New Jersey factory looking for work. Asked what he had been getting, he said $32 a week. This is but one instance. Boys of sixteen and seventeen are now demanding and getting from $18 a week up. There is sufficient labor applying for work, but in large measure it is either undesirable or else of the floating kind looking for higher and exorbitant wages.

Women of all kinds are applying for work. They are being drawn from other industries, from the servant class, and to a slight extent from the store and office. A large number of teachers are entering factories because of the wage inducement. The home also is furnishing a number of women. Girls who never worked before are now seeking employment. In many cases some male member of the family has gone to war and the girls have of necessity had to go to work. There are a number of married women whose husbands are in the army or navy who are seeking employment. Finally there are large numbers of girls going into factories whose father or mother or some friend works in one and urges them to do so.

High Type of Woman Entering Industry

Generally speaking, the type of girl going into industry is a high type. Many have been impelled to this action through patriotic motives—the wish to do their bit. There are instances, however, where the general average of women seeking industrial employment has been lower. In each case where this condition was met a study was made of the locality and the labor competition in that district. Without exception it was found that where the average type was lower industry had already drawn heavily on the female labor supply and that the cream had long been absorbed. Now, with still greater need for female labor, it is but natural that a lower average type is being accepted. When so many industries are bidding for a certain class of labor it is not possible to pick and choose as formerly.

On the other hand, in districts where there was little or no competition the type of girls coming into industry now is as a rule somewhat better than formerly. It probably can safely be said that in districts where there are a number of plants engaged in the manufacture of munitions in which women are employed at very attractive wages the general average of women seeking industrial employment will be lower. Where this condition does not exist the average will probably be higher.

Employers speak well of the quality and quantity of woman's work, and not a few express their surprise that such good results could be accomplished in such a short time. In those factories visited they have been found, on whatever work employed, to be fully as efficient as boys and frequently more so. As a rule, the women do not have so large an output as grown men.

Women More Dependable Than Boys

Women are more punctual and steadier than boys. They do not loaf so much on the work. The tendency of women to absent themselves from work, which has been so prevalent in offices and stores where a regular weekly wage is paid, has been regulated in the factory without difficulty through the time or piece rate system of compensation.

It is generally felt by those employing women that they must be placed on light work only. The best results with women so far have been obtained on light work and quantity production. While it is generally believed that women to be of any use should do the same thing day in and day out, there are instances where girls are running two or three different kinds of machines interchangeably as needed. In only exceptional cases do the women set up their own machines or grind their own tools. Helpers are employed for this work. Girls are not inquisitive about their machines. In some ways this has proved advantageous, for boys with an inquisitive turn of mind have caused considerable damage to valuable machinery.

Old Ideas of Physical Ability Are Changing

Some of the old ideas regarding the physical limit to woman's work are now giving ground under the stress of conditions. Women are being put on work to-day that two years ago factory superintendents would have thought to be too heavy. They are winding heavier coils and running machines that need greater exertion. In every case investigated the results justified the action.

There is one point made by most factory superintendents that is borne out by European experience. That is the matter of training. Superintendents and foremen hold that for women to be a success in the factory the training must be very careful and thorough. Women, it is claimed, will not use their heads on factory work. They will simply do as they are taught. If well taught, their work will be well done. Production will be greater and better in direct proportion to the exactness of the training. Sufficient time therefore must be allowed and the instructors must be competent and patient. They must understand women and be able to bring out the most in them.

Some trouble was expected by employers from male

labor, because of the introduction of women. None, however, has developed in those plants visited. The men appreciate the fact that there is a shortage of labor and that the employment of women was a necessary measure. In most factories the men are very kind to the female operatives and go out of their way to help them.

While the wages in almost every case are lower than those received by the replaced males, there has been no complaint so far from organized labor. However, this wage matter will probably adjust itself before the conclusion of the war. Women are already making demands, and employers fully expect in the long run to have to pay equal wages for equal work.

As regards turnover, the same condition exists as was spoken of in connection with the type of women employed. Where there is little competition the female turnover is very small as compared with the male. Where there is competition, especially from plants engaged on war contracts, the female turnover is as great as, and in some instances more than, that for men. The turnover resulting from marriage is not so large as might be expected.

Women have been employed as a war measure not only in manufacturing but also in other branches of the industry. A number of central stations are known to be experimenting with them in different positions formerly occupied by men. In the meter, billing and collection and in the sales departments particularly women are being tried out.

In subsequent issues of the ELECTRICAL WORLD this subject will be gone into in more detail with special reference to instruction, welfare work, wages, factory changes involved, turnover and legislation.

Central-Station Employee Relations

Faithfulness of Employees During War-Time Stress Due to Foresight Displayed by Managements in Establishing Welfare Work Years Ago—Accident Insurance and Profit Sharing Play Their Part

BY FRANK A. FARNSWORTH, JR.

THE fact is more urgent than novel in any sense that the present is a time of increasing uncertainty in the labor field. The war, with its tremendous claims on overseas interest, has, so far from drawing attention from problems at home, been a means, and a potent means, of bringing this labor question more sharply to the fore. So true is this that consistently with patriotic ends the question undoubtedly is uppermost in the minds of industrial leaders the country over.

While the central-station industry, with its far-reaching ramifications, lays no claim to great foresight in this direction, it can safely include itself among the number that have foreseen to some degree and acted accordingly. The co-operative idea to which reference is made has worked out in this case successfully and with growing momentum, assuming one aspect here and another there, as local conditions determined, but everywhere instilling collective confidence that has reacted in industrial strength and steadiness.

It has long been felt in central-station circles that any suggestion of charity or philanthropy should be avoided in the establishment of relations between employees and their employers. On the contrary, a man-to-man attitude has been in force, in the sense that the employee shall earn his compensation both in the performing of work and in the rendering of service. This last presupposes, of course, continuity of work, together with a degree of devotion that affects not only his own efforts but the tasks of those about him. To insure this devotion and continuity the industry, especially during the last decade, has adopted a series of measures each of which will be described briefly.

INSURANCE AGAINST ACCIDENTS

Second to no other in importance in this series is the insurance of employees against accident, together with the use of every known device for accident prevention. It has been the belief in the industry that the cost of all industrial accidents due to other than deliberate misconduct or gross carelessness should be borne by the employer, who, moreover, assumes full responsibility for the rapid restoring to health of the injured employee. His wages are continued during the interval, and the cost of all medical treatment is met by the company. Should a man be partially incapacitated for life he is put to work at some duty suited to his competence. These and other provisions in the same spirit have been applied throughout the industry as a whole, and needless to say have done incalculably much to foster reliance in one's company and devotion to its interests. Such methods were effective, for example, in the New York Edison Company long before local industrial conditions called for the passage of the workman's compensation act. While compelled to readjust its practice to conform to this act, the New York Edison Company has since contented itself with nothing less than making up the difference to the employee between the compensation prescribed by law and the full compensation paid him before its passage, provided that the employee conscientiously follows out the instructions of the company's physicians.

With regard to accident prevention, the same company has adopted a course thoroughly typical of the industry in general. To such an extent has the protective sheathing of parts been carried in the New York stations that the probability of accidents is reduced to a minimum. Not only do voltage numbers, "hold off" signs and other such announcements confront the employee at every turn, but when work is to be done in installing or in connection with high-tension apparatus the issuing of notices, the preparing of sketches and the making of records at each single step preclude trouble all but absolutely. Systematic inspec-

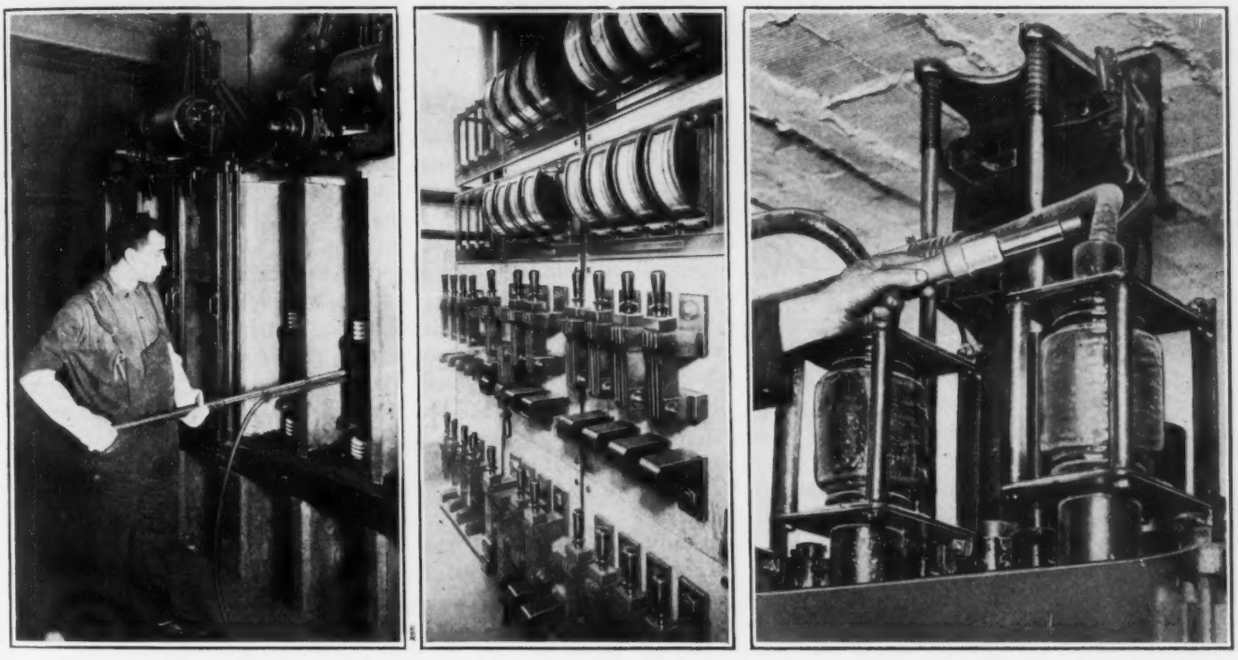
TYPES OF EMPLOYEE HOMES BOUGHT THROUGH THE NEW YORK EDISON SAVINGS AND LOAN ASSOCIATION

tion and the providing of hand rails, rubber mats and rubber gloves are effectively seconded by the distribution of operating rules with which every man is required to familiarize himself. By way of a final safeguard, and one perhaps as essential as all the others, the company in question maintains a technical school for employees which aims not only at the imparting of technical skill but at the development of mental alertness and accuracy of judgment. Such means taken for his protection have not failed to promote in the employee both a confidence in his surroundings and a trust in the organization of which he is a part.

While accidents at times occur despite every precaution humanly possible, industrial sickness as commonly known is practically absent. However, ordinary sickness applies here as elsewhere and has offered a further scope for co-operative interest. With this in view, benefit associations have in general been established throughout the industry. Aided by the em-

ploying company, these have followed a successful and practical development. Owing to such means, the old custom among employees of "passing the hat" whenever it was necessary to raise money for the funeral expenses of a fellow employee or when his dependents were left without means has been done away with. The general opinion has prevailed that with the assistance of the employing company these co-operative societies can contribute approximately 50 per cent of the wages of an employee when sick at a cost of approximately 1 per cent of his wages; furthermore, that a death benefit of from $300 to $500 can be paid with a weekly contribution ranging from 10 cents to 15 cents.

Among many such associations in the industry that of the Southern California Edison Company is the most recent to be reported. This company, it seems, has volunteered to collect the assessments through its payrolls, turning the amount so collected over to the treasurer of the fund, and also to advance money to the fund in case a loss has to be paid before the assessment can be collected. The average cost of the amount of insurance agreed upon has been a little less than 44 cents a month and compares favorably with any class of insurance obtainable anywhere. The fact that no item of expense of any sort is charged against the fund makes it possible to give the beneficiary every cent contributed. It has further been an unwritten law to pay benefits with the utmost promptness. What this particular fund is doing in removing the distractions of worry and necessity is reflected in many similar associations in as many companies under whose patronage and with whose help such benefits are made possible.



EMPLOYEES ARE OBLIGED TO USE RUBBER GLOVES, SWITCH GUARDS, ELECTROSCOPES AND OTHER SAFETY APPLIANCES PROVIDED BY THE COMPANY

SERVICE ANNUITIES

An exceedingly forceful factor in the advancement of confidence and loyalty is the provision of service annuities. The practice prevails among central stations in general, and the age prescribed for the receiving of an annuity on a basis of permanent service is, roughly speaking, sixty-five years for a male employee and sixty years for a female employee. The term of continuous service in the organization is approximately ten years. The cost of such annuities is contributed by the individual company as part of the annual cost of labor. Obligation to pay the annuity ceases only in the event of the employee's breaking voluntarily the continuity of the term. This naturally does not apply in case the employee is laid off temporarily through no fault of his own. A break of this sort is looked upon rather as an interruption. Such, broadly speaking, are the pivotal considerations on which the plan rests and on which it has succeeded in helping labor to rely in the central-station industry.

The service annuity plan of the Edison Electric Illuminating Company of Boston illustrates a concrete working out of the idea. This plan specifies that "any male employee who shall have reached the age of sixty-five years and who shall have completed fifteen or more years of continuous active service (the age for female employees is sixty years) shall at his or her request or at the discretion of the committee be retired from active service with a service annuity." The Boston plan goes on to provide that "any male employee who shall have reached the age of sixty years and who shall have completed twenty or more years of continuous active service (the age for female employees is fifty-five years) shall at the discretion of said committee be retired from active service with a service annuity." Any employee who shall have completed thirty or more years of such service can, under this arrangement and irrespective of age, be retired at the committee's discretion with an annuity.

The amount of this annuity to be paid each year is 1 per cent of the average annual pay of the employee during the last ten years of active service multiplied by the number of years of service. It is provided,

however, that no service annuity shall be less than $300 a year. With this surety ahead of him the employee cannot but feel at home and secure as a central-station man.

SHARING PROFITS WITH EMPLOYEES

What the Southern California Edison Company has adopted in the way of profit sharing may be cited briefly as showing what a prosperous unit of the industry is doing to promote in this way the cohesion of capital and labor. The cardinal features of the plan are as follows: On due authorization the company last August issued $2,500,000 of its common capital stock, and all employees were given an opportunity to subscribe under carefully worked-out conditions. These conditions were as easy as consistent with conservative financing, and permitted an employee to subscribe for shares of par value equal to not more than ten times his monthly salary. Such subscriptions are paid for by deductions from monthly pay checks of a sum equal to 7½ per cent of the past month's salary and credited to the purchase price of the stock. Subscribers are also credited with all dividends which accrue from the date of subscription, and these dividends apply as payments on account of the profit sharer's stock together with the 7½ per cent deducted from his salary. When payments have been completed stock certificates are issued, and thereafter checks are mailed to stockholders as dividends are declared. If they wish, profit sharers of course can pay as much more as they desire upon their stock, the 7½ per cent having merely been decided upon as the limit of deduction. At the price which the stock was and is bringing to employees, the interest is equal to practically 8 per cent, or more than double what can be obtained from savings deposited in any sound institution. After a trial of six months this plan has amply justified its inception. It may be said, in fact, that a general plan of this nature advocating profit sharing through the ownership of stock on the part of the employees has become an all but prevailing policy in the industry.

A still further provision whereby the central-station employee is drawn sympathetically to the industry and markedly to his immediate organization—a provision looking to confidence in the concrete and economic sense—is that of the savings fund. The idea, which was included some years ago as part of the industry's public policy, aims to encourage thrift among employees, not alone as a resource in emergency but even to the degree of home ownership. The two outstanding features in the general project were and are a guarantee by the company of the security and safe return of the funds and the affording to employees of every convenience in making their deposits. Under the conditions it was felt that more than the ordinary savings-bank rate of interest could usually be paid.

Though the savings association of the New York Edison Company may possibly not be more effective in its field than similar associations in central-station companies in many parts of the country, special reference may be made to it here inasmuch as the very latest figures are at hand. This association was started in 1912 and within five years had distributed to its membership $69,554 in dividends. This item alone for the past year amounted to $26,962, while the money deposited in the same year aggregated $285,882. The smallest deposits have been acceptable, and the way has been made easy for every member of the company to save something, however little. By way of illustrating share earning, mention may be made of the first installment series, of June, 1912. The dues paid on a share in this series amount to $67, and these in turn have earned $12.83 in dividends, bringing the present value of the share to $79.83. To continue through the list would be to meet at every point results emphasizing the benefits of such membership.

A word has already been said regarding the desire to make employees a home-owning class. With this in view, bond and mortgage activity has marked the association from the start. During the past year this activity has brought about total loans numbering 129, with a value of $392,000.

Installment mortgages can be carried for $10 monthly on each thousand dollars loaned—half of the charge, or the portion representing dues paid, operating continuously toward the reduction of the principal sum. These loans may be made either for the purchase or building of homes, for the transfer of existing mortgages or for home improvements. In every instance the association stands ready to render the greatest aid with respect both to the loan itself and to the preliminary details. In the case at least of this association all expense of operation is borne by the company. That the expense involved in clerical work is in itself a very considerable item and one that otherwise would appreciably reduce the dividends now possible is seen in the one fact that 80 per cent of the members pay their dues in weekly installments.

With figures immediately available, mention may be made in this connection of a highly popular and successful insurance privilege of which four-fifths of the employees of this company have availed themselves. The type of insurance offered is what is known as the "group term," the amount of the primary offer being $250, to which $100 is added gratuitously by the company in case of death. The fee under this plan is 65 cents a quarter, or 5 cents a week. Policies more substantial in amount up to $1,000 may be taken out by any employee without physical examination, provided he does so within one year after his entering the organization. The policies in this case may be of any sort a man may care to take, and the fees are at the regular standard rate.

THE SOCIAL SIDE OF WELFARE

Much might be said, and of a most interesting description, regarding other helps which the various companies in the central-station industry afford their employees, with emphasis particularly on the social side. Indeed, any discussion of employee clubs and clubhouses would require an article of itself. However, enough perhaps has already been pointed out to show that exceedingly much has been done by the industry to infuse the human element into its employee relations and eliminate unfortunate infelicities and misunderstandings that stand in the way of cohesive co-operation. This infusion and this elimination, which have so long been the aim of those who have sought and striven for happier conditions for their fellow men, may in truth be said to be realized in this industry and stand out even in these troublous times.

Avoiding a Preventable Loss

Soot and Its Effect on Heat Transfer Through Boiler-Heating Surface — Relative Steam Consumption of Mechanically Operated Soot Blowers Versus Hand Cleaning —Effect on Coal Pile, Labor and Maintenance Cost

DURING recent years the boiler room has gradually emerged from a position of secondary importance to a primary element in the cost of power generation. Boilers have been growing in size, combustion rates have increased, and greater loads per unit of steam-making surface are being carried. With the operating conditions becoming more severe and fuel cost high above the normal level of years past, closer scrutiny is being given to all factors affecting economy.

Loss from Soot Formation

Of all the preventable losses, that caused by the formation of soot on the fire surfaces of the boiler is perhaps the most troublesome. Cracks in the setting may be detected and the leakage of air into the setting may be stopped. Proper insulation will reduce radiation, and scale on the water surfaces may be eliminated to a large extent by the use of pure or softened water. The formation of soot and ash, however, is universal and continuous as long as there is an active fire under the boiler. Depending upon the degree of combustion and arrangement of the setting, the quantity of soot varies and its character differs with the fuel, but there is no stopping of its formation. Even if conditions were ideal and combustion complete, a heat-insulating coating composed largely of ash would form on the tube surface.

As a rule the soot found in boilers is not pure soot or carbon. It contains a varying proportion of ash, so that the color may be light gray, red, brown or black where conditions are particularly unfavorable to good combustion. In coming from the furnace the soot particles are more or less plastic and readily adhere to the metal surface of the tubes. Unless the deposit is quickly removed the carbon on the tubes near the fire will burn out in part, fusing the various ingredients into a hard coating which increases rapidly as the gas temperature rises because of the insulation of the tubes. In water-tube boilers it is not uncommon to find on the heating surface near the fire hard clinker-like formation, in some cases bridging the tubes. Even with efficient and frequent cleaning it is practically impossible to keep the lower tubes near the fire entirely free of this slag-like formation. Further back the soot does not contain so large a percentage of ash. It is usually darker in color and the formation is not cemented together. Loose deposits rest on all retaining surfaces, such as the upper portions of the tubes.

With all kinds of fuel, then, there is formation of soot. Anthracite contains a low percentage of volatile matter, but may run high in ash, so that the deposit is largely the latter constituent and is usually of a light powdery character. With bituminous coal, high in both volatile and ash, there is a large percentage of carbon in the soot, particularly if the furnace conditions are not favorable to good combustion. In waste-heat boilers deposits of fine powdered dust carried along with the gas are to be found, and even with oil fuel there is some formation of soot. Owing to excellent combustion the quantity is small, but as the deposit is pure soot of high insulating value, its removal is important from an efficiency standpoint. The soot evil also extends to the economizer, the deposits resembling the boiler soots. Because of the lower temperatures the formation is more profuse and its interference with heat transmission relatively greater as the difference in temperature between gas and water is less.

It has been commonly stated that next to loose wool loose lampblack or soot is the best insulator known. In this respect it is ahead of hair felt and is more than five times as effective as fine asbestos. All this may be true, but boiler soot is not all lampblack. The varying percentages of ash and the density and structure of the deposit will naturally affect the insulating properties. Besides, the coating is not evenly distributed, so that part of the surface at least will be comparatively clean. If the maximum heat transfer through the boiler tubes is to be maintained, however, all of the heating surface must be kept clean, and this is particularly true where boilers are forced over normal rating, as is the practice in modern plants. If the soot is allowed to remain, another bad feature is the formation of carbonic and sulphuric acids, which act on the metal of the boiler, causing leaky tubes and general deterioration that will shorten the useful life of the boiler. It is quite evident, then, that soot must be removed if the best results are to be obtained, and the question at issue is the easiest and most efficient method of doing this.

Methods of Removing Soot

For this purpose there are the hand lance and the mechanical blower. The former, consisting of a rubber hose and nozzle, was the first device to be used. It is, of course, very simple, and the initial cost is small. Two men are required to operate it—one at the boiler to handle the nozzle and the other at the steam valve. The work is naturally hot, dirty and disagreeable, and on a medium-sized boiler it takes from twenty to thirty minutes. Usually there are not more than one or at most two blowings per day of twenty-four hours. The lance is inserted through dusting doors in the setting, and there is no opportunity for the operator to see the result of his work. Unless he is conscientious beyond the average the surface may be poorly cleaned and some sections be neglected entirely. Usually the lance does not reach all of the heating surface, the area covered being determined by the kind of dusting doors, the width of alley space at the side of the boiler and the range of the lance due to the angle of the dusting door. Another objection commonly advanced against hand blowing is the fact that when soot is blown across the tops of the tubes it strikes the battery wall and tends to pile upon the far tubes, contrary to the argument that the draft will carry it off.

Moreover, there is the additional objection of large quantities of cold air being drawn into the setting during the period the steam lance is in operation. This means less efficient combustion.

Labor is another item entering into the comparison. The mechanical blower requires but one man, and the time of blowing is, say, one-fourth as long, so that the

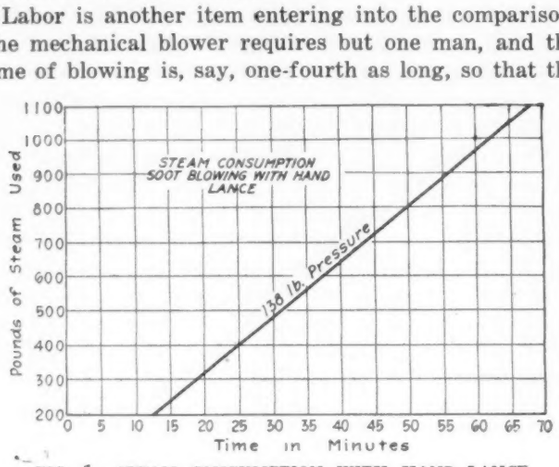


FIG. 1—STEAM CONSUMPTION WITH HAND LANCE

ratio is eight to one. With very large boilers it may be considerably higher. Local conditions, size of plant, etc., determine whether the saving in time will be sufficient to dispense with the services of employees retained for this work.

Objections offered to the mechanical blower are initial cost, running from 5 to 10 per cent of the cost of the boiler, the burning out of the elements exposed to the hottest gases direct from the furnace, and warping. The objection last named, warping, has always been a serious problem. It is a well-known fact that metal begins to warp long before it reaches a temperature that will cause corrosion or burning of the metal. For that reason it is necessary to construct the element so that it will have strength to resist the warping; for as soon as this action begins the element will be thrown out of line, it will bind in the bearings and the operator will be unable to turn it.

The initial cost is comparatively small when compared to a 5 per cent saving in the fuel bill, the reduction in labor and the convenience of operation. Destruction of the elements near the fire has been obviated to some extent by the use of special metal having high heat-resisting qualities and by so placing the elements that they are protected from the direct heat of the furnace when in the non-operating position. Corrosion, due to back suction of the boiler gases into the blowing elements, has been reduced by the use of special air valves, and special precautions have been taken to drain the piping system of the blower to prevent condensation being forced out onto the heating surface to interfere with soot removal and to corrode the metal. These various improvements, better placing of the elements and nozzles of improved design have so perfected the mechanical blower that, according to reports from numerous users, the services rendered are excellent and the maintenance charges are comparatively small.

While users of the mechanical soot blowers realize that they are getting better heat transfer, that the flue gases are lower in temperature and that the boiler efficiency has been improved, there is a lamentable lack of specific data showing the saving actually effected and the average cost of maintenance. The blowers have been installed. They are giving satisfaction. The boilers will carry more load, and it is known that the flue temperatures are considerably lower than previous to the installation. During the first two or three years of use repair parts are required occasionally. Depending upon the service, the average life of the blower is at least five or six years. The labor of blowing has been reduced, and as the work is less arduous, it is performed more frequently and with better results.

Such was the gist of replies from a large number of power-plant owners and engineers to whom inquiries had been sent by the ELECTRICAL WORLD concerning the saving in fuel and labor effected by the installation of mechanical blowers, the cost of maintenance and the degree of satisfaction the blowers gave in service. The substance of some of the replies, more specific than others, is presented in the following:

The Iowa Falls Electric Company has equipped three Edge Moor water-tube boilers of the four-pass type with soot blowers. Two of the boilers were rated at 410 hp. and the other at 550 hp. The boilers had previously been blown by hand, and the work required the full time of one man at a cost of $850 per year. In the company's opinion it took a remarkably good man to stand up beside a hot boiler and blow every tube. Frequently some of the tubes were missed, and the result was a reduction in efficiency. Besides, a man could not hold a hose carrying 175-lb. (12.3 kg. per sq. cm.) steam pressure. It had taken the company two months to get all of the old scale off the tubes caused by blowing them with wet, low-pressure steam. The principal advantage of the mechanical blower in its estimation was the fact that full boiler pressure could be used and that better results were obtained. Since the installation of the blowers the services of the man previously mentioned had been dispensed with, and the firemen were blowing the tubes twice on every shift. The saving in coal was placed at 15 per cent. The blowers had been in service one year, and the maintenance expense had been the cost of 1 pint (0.47 l.) of oil to lubricate the swing joints.

The Iowa Railway & Light Company of Cedar Rapids

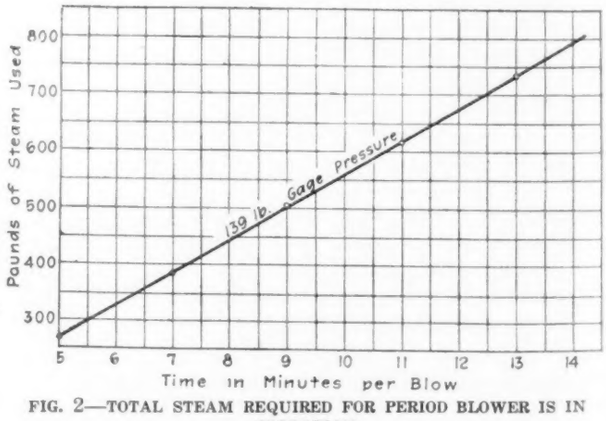


FIG. 2—TOTAL STEAM REQUIRED FOR PERIOD BLOWER IS IN OPERATION

had installed mechanical soot blowers on twenty-nine Edge Moor water-tube boilers during a period extending from 1909 to 1918. The company knew that the blowers were a great help both in labor and economy, but could give no definite figures. It had been found that the blowers would not keep clinkers off the first row of tubes. Here was a chance for improvement.

In the plant of the Indianapolis Light & Heat Company fourteen boilers, ranging in size from 500 hp. to 800 hp., were equipped with mechanical blowers. If properly operated, the blowers saved approximately 15 per cent in fuel and labor. About 12½ per cent of this saving was attributed to higher boiler efficiency and 2½ per cent to a reduction in labor cost. The maintenance had been approximately $5 per installation per month.

The Richmond Light & Railroad Company had blowers on ten 606-hp. B. & W. boilers, equipped with Taylor stokers. The maintenance on the blowers, which had been installed from one to two years, had been practically nothing. The company had no accurate data to show the saving in coal and labor, but was satisfied that the blowers were a good investment.

The Edison Electric Illuminating Company of Brooklyn had in use blowers on seventeen B. & W. boilers averaging 650 hp., and forty-five additional units were being installed. Installation work had begun in November, 1916, and no definite figures as to fuel saving are available, as the majority of the boilers were

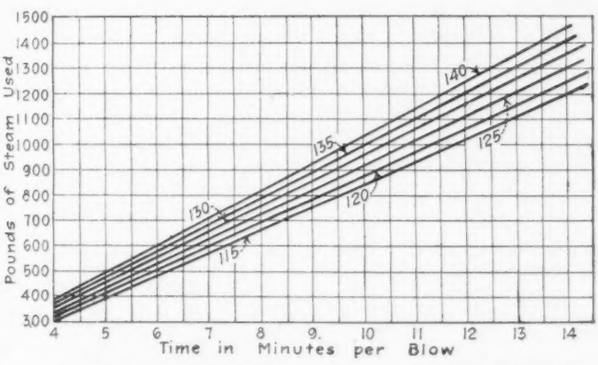


FIG. 3—STEAM CONSUMPTION OF 2-IN. BLOWER FOR VARIOUS PRESSURES

still blown by hand. In the opinion of the operating engineer there was no question that the boilers were much cleaner by the use of the mechanical soot blower, and as a result a saving in fuel must result. When all of the soot blowers were installed, the labor saving would eliminate the services of five men and would amount to about $13 per day.

Soot blowers on 4900 hp. of Stirling boilers are in use at the plant of the Indiana Railways & Light Company of Kokomo, Ind. No tests have been made to determine the percentage of saving. Cleaner tubes so clearly indicated a saving that the question had not been analyzed. It had been their experience that the soot blower complete had to be removed in from five to six years.

Four 750-hp. Bigelow-Hornsby boilers in the plant of the Salem Electric Lighting Company of Salem, Mass., had been equipped with soot blowers in 1915; five blowers were installed on 280-hp. Heine boilers in the plant of the Rockland Light & Power Company of Nyack, N. Y., in 1914, and in the same year a 600-hp. B. & W. boiler of the Malden Electric Company of Malden, Mass., was equipped with a blower. In the plant first mentioned the saving in labor was $675 per year, in the second plant $411 per year, and in the Malden plant the labor saving was undetermined. Blower repairs in the three plants had been negligible. In the opinion of the engineering manager controlling the three properties there was no question that there had been a saving in fuel on all the boilers equipped with mechanical soot blowers, as it was possible to clean the tubes twice in twenty-four hours so that the heating surface was maintained in much better condition. No exact data were available.

The Central Hudson Gas & Electric Company of Poughkeepsie, N. Y., had equipped six of eight Stirling boilers with mechanical blowers. These blowers were much more effective than the compressed air they had previously used, and there was a considerable reduction in labor.

Installation of soot blowers on two 400-hp. Heine water-tube boilers in the plant of the Chester Valley Electric Company of Coatesville, Pa., in the year 1911 had resulted in a saving in the operation of the plant roughly estimated at 5 per cent. The above figure was considered conservative and was divided into 1 per cent in labor and 4 per cent in fuel. The maintenance charges, which had been small, were placed at $100 in seven years.

With blower installations on two 350-hp. Heine boilers and two Stirling boilers for several years, the Texas Power & Light Company placed the cost of upkeep at $5 per blower per year. A saving in fuel of approximately 10 per cent was estimated over hand blowing.

The public lighting plant of the city of Detroit had installed soot blowers on two 685-hp. Stirling boilers on April 21, 1916. To clean the soot from two 400-hp. Stirling boilers by means of a steam hose from ladders required the labor of two men for about three hours. With the mechanical blowers the battery of two 685-hp. boilers was cleaned by one man in one-half hour, the ratio being twelve to one in favor of the mechanical blower. So far there has been no maintenance expense.

One of the large central-station companies of the country has equipped fifty-five boilers with mechanical soot blowers. These blowers are of competitive types, and a few of home manufacture. Fifteen of the installations have been made on Stirling boilers rated at 2365 hp. that operate between bank and about 200 per cent of rating. On overload the temperatures are high and the conditions severe, so that it has been found necessary to assist in the further development of the blowers. To clean one of the large boilers by hand requires twelve to fourteen hours' time with two men operating. These men receive 38 cents per hour, so that the labor cost for hand blowing averages about twenty-six hours of 38-cent time, or just under $10 per 2500 boiler-hp. per twenty-four hours.

With soot blowers installed two men blow a boiler in about one hour. They blow each boiler three times per day, so that the total labor cost approximates $2.30 per 2500 boiler-hp. per twenty-four hours. Thus the labor item is reduced to less than one-fourth, and the boiler has the advantage of three cleanings per day. The job is much better done, and no useless air is admitted through open doors. The effect of this factor will be appreciated when it is noticed that it takes from twelve to fourteen hours to blow one of the boilers by hand.

To clean one of the big boilers with a mechanical blower requires about 3500 lb. of steam per blow. Three operations per day would require about 10,500 lb. (4762.7 kg.) of steam per 2500 boiler-hp. every twenty-four hours.

The maintenance charges on soot blowers had not been separated from certain other somewhat similar costs, but it was estimated that soot blowers properly installed could be kept in good operating condition with a maintenance expenditure of not over $200 per 2500 boiler-hp. per year. The average charge had been higher than this, but it was due to the fact that certain parts as originally designed and installed had given out frequently and had to be replaced. Owing to imperfect methods used for measuring flue-gas temperatures accurate data were not available to indicate the thermal advantage obtained from the use of soot blowers. It was believed safe to assume, however, that mechanical soot blowing maintained a flue-gas temperature about 30 deg. to 40 deg. lower than could be maintained with hand blowing, and unless the latter operation was completely and conscientiously done, the difference would be more nearly 80 deg. to 100 deg. less.

PRACTICAL SUGGESTIONS FOR ECONOMY IN USE OF FUEL

By Using High-Grade Coal at Peak Time Poorer Coal Can Be Utilized at Other Periods Without Increasing Boiler-Room Investment

BY P. B. JUHNKE
Chief Load Dispatcher Commonwealth Edison Company

THE ever-increasing fuel requirements of this country entailed by the immensely increased industrial requirements focus the engineer's attention on a subject not generally considered heretofore. It is the burning of lower-grade fuels without greatly increasing the boiler-room investment.

The steaming value of a given coal is within certain well-defined limits a function of the size of the coal; likewise, the price of coal is dependent on the size selected, screenings being rated lowest in value. While their test B.t.u. value may be equivalent to that of any given coal, their steaming value in boiler rooms is considerably lower than similar screened coal. However, as screenings will always be a necessary by-product in the coal industry and as 90 per cent of the time they are sufficient, they constitute the logical fuel for central stations.

Burning the lower grade of fuel exclusively, however, requires additional boiler-room equipment over what would be required with the more expensive screened coal for a given steaming capacity. The additional investment required is vitally important to central-station companies, whose loads have the familiar sharp peaks, during which time alone the development of maximum capacity is necessary.

A decided step in the direction of economy of both boiler-room investment and high-grade fuel has been made by the Commonwealth Edison Company in its principal generating stations during several peak seasons. The fuel ordinarily burned is not quite sufficient for the development of maximum capacity during the winter evening peaks, and is supplemented in these periods by higher-grade fuel, to permit maximum output. This is done by storing the more suitable coal on the floor and during the peak supplementing the stoker firing of lower-grade fuel by hand firing of the higher-grade fuel in the proportion of approximately fifty-fifty. Such practice permits good combustion of the entire supply and enables the stations to carry their rated full load and more at the most critical time of the daily load, something that would be scarcely possible were the hand firing of high-grade coal not resorted to.

This scheme of developing full load, however, is not altogether free of objections. First, it requires that a large amount of coal be stored on the boiler-room floor, a poor place for coal according to modern conceptions. Second, it requires a large amount of help to store and shovel the coal into the stoker, and this help may be difficult to obtain and is quite expensive.

To overcome these difficulties a scheme has been adopted at the Fisk Street station which has proved quite satisfactory. High-grade coal is kept in one bunker out of every group of sixteen, and the corresponding boiler is kept banked at all times except during peak loads. A traveling bucket movable by a crane is filled from this bunker to supply high-grade fuel to any other hopper requiring it. This arrangement has reduced the labor expense considerably.

Despite the aforesaid difficulties connected with this method of supplementing low-grade with high-grade coal when required, the underlying principle seems good enough to demand special consideration from designers who look to the fuel situation ahead. Provision for auxiliary high-grade coal bunkers that will be large enough to meet the increased demands during peak periods has been made in a few stations, but it might be advisable for all future stations. The capacities of such bunkers need hardly exceed 5 per cent to 10 per cent of the ordinary bunker capacity. Perhaps one or more central bunkers with chutes to a number of stokers would be desirable, but the method of storing and distributing the coal is mostly a matter of detail arrangement.

It is not difficult to imagine conditions which will give additional economic importance to providing auxiliary bunkers for peak coal, conditions which will affect operating costs as well as investment cost. When they obtain, such an arrangement will recommend itself still more forcibly and is likely to show a decided saving both in the outlay for investment and in operating costs.

To state offhand the saving effected in dollars and cents is somewhat difficult, as location, the price of coal, cost of boiler equipment, and the like, are factors entering into the matter. Outside of the auxiliary coal bunkers, very few other changes will be necessary to adjust the fuel to the load conditions. With such an arrangement one precaution would have to be taken —to prevent waste of the higher grade coal, it being much easier to burn. With hand firing the difficulties connected with burning the higher-grade fuel serve as a good brake against this tendency in human beings to make things as easy for themselves as possible. But even at the worst it would not be a grievous problem for modern types of generating-station executives to solve.

In all events, the conservation of high-grade fuel is an important matter. This suggested development is not only a method of offsetting higher coal prices and effecting economies, but may be a necessity dictated by the anticipated post-war activity and commercial rivalry between the nations trying to restore the sadly depleted accumulations of decades.

Industrial Trucks in War Service

Shipyards, ammunition factories, army depots, khaki cloth mills, arsenals and other war plants all have had their work speeded up by the electric truck. Thousands of these vehicles are now in use, thereby releasing men for employment in other occupations where labor is much in demand.

Economical Use of Copper

Does It Pay a Company to Maintain on the Pole Line, in Anticipation of Additional Load, Copper Wire That Remains Idle or That Is Not Working Sufficiently?

BY P. O. REYNEAU
Distribution Engineer Detroit Edison Company

WITH the increased price of copper and the unreliable deliveries brought about by the war the most efficient possible use of wire becomes a vital problem in many places. It becomes necessary to take stock and make the available wire in the warehouse and on the line go as far as possible. In many instances very radical changes are necessary.

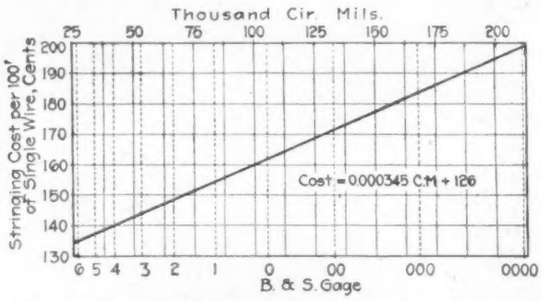


FIG. 1—AVERAGE WIRE-STRINGING COSTS FOR POWER LINES

Many of these changes are not good engineering or good economics fundamentally, but they are forced upon operating companies by absolute necessity. In order to keep as nearly as possible on the right track it becomes imperative to analyze the situation critically and determine in so far as possible the relative value of all the factors entering the proposition, especially those that can be gaged in a concrete manner. Therefore the object of this paper is to attempt to suggest a way of handling the copper in distribution systems as they exist to-day.

As a starting point we can consider any distribution system of the present day and look at it critically, studying its load conditions and its saturation in various parts. There are all kinds of systems—good, bad and indifferent. Some have been built up without a clear concept of the underlying fundamentals of good distribution. Their growth has often been affected mostly by physical conditions, the laying out of streets, the regulations imposed upon operating companies by state, county or city governments. Each superintendent has developed his distribution system according to methods that seemed to fit in best with the conditions at the time of building, changing these methods as outside influences made it necessary to do so. Even where the best talent has been used for designing the system and where no expense has been spared to keep up with the latest improvments, it is very often true that those in charge have been so busy operating the old and putting in the new equipment that they have not had time to stop and look their distribution system over to realize how time has changed their conditions. For these reasons we shall find nearly everywhere that some wire is not working at all though it is probably charged, that other wire is working far below its full rated load (determined by economical considerations and modified by its relative location and use in the system), and finally that some wire is overloaded, thereby causing losses greater than those allowed under economical operation. These conditions are usually natural ones; they are the result of unforeseen conditions such as unexpected or abnormal growth or decline of load.

It is not the purpose here to deal with overloads except by suggesting that idle wire could well be used in many cases to relieve them. The problem which will be considered can be summed up in one question: Does it pay to maintain on the pole line, in anticipation of additional load, copper wire that is idle or that is not working sufficiently? A question of such broad character cannot be answered with a yes or a no without any qualifications, but concrete information can be presented which should assist good judgment in approaching perfection.

In the first place, if the wire will not be put in service in its present location it is self-evident that it should be removed to the warehouse at the first opportunity and put up again as soon as needed in another location. The interest and depreciation on the wire is a net yearly loss while it is not being used. If it were in the warehouse as a part of the stock which must necessarily be kept on hand, the necessity of purchasing the same amount of new wire would be eliminated. If it were giving service on some line it would be earning a return on the investment. Even where the insulation is so far destroyed that the wire has only junk value its sale will permit the purchase of a certain amount of new wire. It should be noted that the expense incurred in taking down the wire will practically always be very small compared with the cost of the wire. It should also be noted that the first cost of installation of the wire (possibly from 10 per cent to 60 per cent of the original cost of the wire) is a net property loss when the wire is removed. This loss to property really exists just as much whether the wire is up or down; the net loss of leaving it up remains the interest and depreciation yearly charge on the wire.

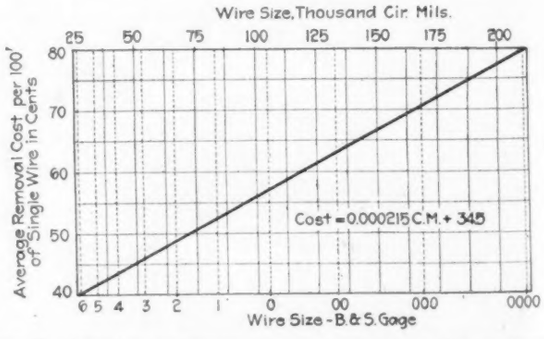

Wire Size, Thousand Cir. Mils.
25 50 75 100 125 150 175 200
Average Removal Cost per 100' of Single Wire in Cents
80 70 60 50 40
Cost = 0.000215 C.M. + 345
6 5 4 3 2 1 0 00 000 0000
Wire Size - B. & S. Gage

FIG. 2—AVERAGE EXPENSE OF REMOVING PRIMARY CIRCUITS

*Assisted by C. E. Mowrer.

In many cases it is impossible to determine definitely that lines will never be used again. When this is so it would be wise to hesitate about removing any wire from the lines unless forced to it by necessity. In order to make the proposition more definite, however, let us consider that a certain amount of wire is idle on the pole line at present but that it will be put to work

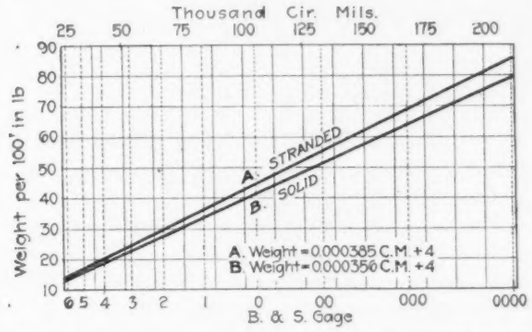


FIG. 3—AVERAGE WEIGHT PER 100 FT. OF TRIPLE-BRAID WEATHERPROOF WIRE

some time in the future. In this case the time during which the wire will be idle is the determining factor in the study of economy.

A. If the idle line is taken down and used and no new wire is bought, the following costs are involved:

Removal cost from old position.

Stringing cost of new wire.

Interest and depreciation on wire for length of time before it will need replacing in old position.

Cost of stringing new wire in old position at end of that period.

B. If the old line is left up and new wire bought to build present extensions, the costs involved are:

Stringing cost of new wire.

Interest and depreciation on old wire left up idle.

Interest and depreciation on new wire.

Equating the cost of operations A and B and solving for the time gives that length of time in years where the costs involved in leaving the line up idle and buying new wire to fill present needs just equal the costs involved in taking it down and restringing it. In other words, if the line is to remain idle longer than this period of time, it will pay to remove it at once and then replace it when necessary. If the line must be replaced sooner than this time, it would not pay to take it down. Several factors enter into both sides of the equation and may be eliminated from the calculations,

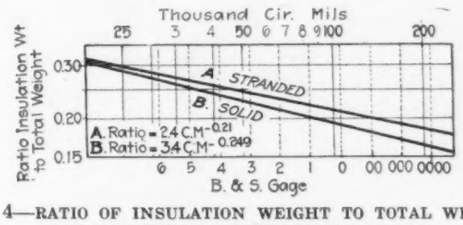

Thousand Cir. Mils
25 3 4 50 6 7 8 9 100 200
Ratio Insulation Wt to Total Weight
0.30
0.20
0.15
A. STRANDED
B. SOLID
A. Ratio = 2.4 C.M.^-0.21
B. Ratio = 3.4 C.M.^-0.249
6 5 4 3 2 1 0 00 000 0000
B. & S. Gage

FIG. 4—RATIO OF INSULATION WEIGHT TO TOTAL WEIGHT FOR TRIPLE-BRAID WEATHERPROOF WIRE

leaving the following as active terms: (1) Removal cost from old position, restringing cost in old position; (2) interest and depreciation on new wire.

The method of procedure is as follows: Wire stringing and removal costs per 100 ft. (30.5 m.) of single wire have been obtained from available data, these costs being plotted against wire size in Figs. 1 and 2. To reduce the cost of wire to a curve, the average weights per 100 ft. were plotted against wire size (Fig. 3). As the wire depreciates only in so far as insulation is concerned, the annual depreciation rate will be $6\frac{2}{3} \times$ (insulation weight $\div$ total weight), if the copper market is stable, assuming the life of insulation to be fifteen years. Curves for this ratio are plotted against wire size in Fig. 4. Finally, by combining the several curves and their equations, an equation and curve was found, as shown in Fig. 5, that expresses the relation desired.

The expressions for each relation and methods of combining them to give the final equation are shown in the following. It should be noted here that interest was taken at 6 per cent and the cost of copper at 30 cents per pound (13.6 cents per kg.). Other values can be substituted in the equation. For a more general solution it would be desirable to carry these factors through the equations to a final one where any value could be substituted, but this procedure would have complicated the final equation too much for this discussion.

Solid Wire

$$\text{Years} = \frac{(\text{stringing cost} + \text{removal cost}) \div \text{total annual fixed charges}}{\text{Circ. Mils}}$$

$$\text{Stringing cost} = 0.000345 + 126$$

$$\text{Removal cost} = 0.000215 + 34.5$$

$$\text{Total} = 0.00056 + 160.5$$

$$\text{Cost of wire/100 ft.} = \text{cost/pounds} \times \text{weight/100 ft.} = 30 \times (0.000356 \text{ circ. mil} + 4)$$

$$\text{Cost of wire in place} = \text{original cost} + \text{stringing cost} = 30(0.000365 \text{ circ. mil} + 4) + 0.000345 \text{ circ. mil} + 126 = 0.01068 \text{ circ. mil} + 120 + 0.000345 \text{ circ. mil} + 126 = 0.011025 \text{ circ. mil} + 246$$

$$\text{Interest/year on investment} = 0.06$$

$$\text{Depreciation/year on investment} = 0.067(3.4 \text{ circ. mil}^{-0.249})$$

$$\text{Interest and depreciation/year} = 0.06 + 0.067(3.4 \text{ circ. mil}^{-0.249}) = (0.06 + 0.226 \text{ circ. mil}^{-0.249}) \text{ in per cent}$$

$$\text{Annual fixed charges} = (0.06 + 0.226 \text{ circ. mil}^{-0.249})(0.011025 \text{ circ. mil} + 246)$$

$$\text{Years} = (0.00056 \text{ circ. mil} + 160.5) \div [(0.06 + 0.226 \text{ circ. mil}^{-0.249})(0.011025 \text{ circ. mil} + 246)]$$

$$\text{Years (solid)} = (0.00056 \text{ circ. mil} + 160.5) \div (14.75 + 0.00066 \text{ circ. mil} + 0.00249 \text{ circ. mil}^{0.781} + 55.6 \text{ circ. mil}^{-0.249}) \quad (1)$$

Stranded Wire

$$\text{Years} = \frac{(\text{stringing cost} + \text{removal cost}) \div \text{total annual fixed charges}}{\text{Circ. Mils}}$$

$$\text{Stringing cost} = 0.000345 + 126$$

$$\text{Removal cost} = 0.000215 + 34.5$$

$$\text{Total} = 0.00056 + 160.5$$

$$\text{Cost of wire/100 ft.} = \text{cost/pounds} \times \text{weight/100 ft.} = 30 \times (0.000385 \text{ circ. mil} + 4) = (0.01155 \text{ circ. mil} + 120)$$

Cost of wire in place = original cost + stringing cost
= (0.01155 circ. mil + 120) + (0.000345 circ. mil + 126)
= 0.011895 circ. mil + 246

Interest/year on investment = 6 per cent = 0.06

Depreciation/year on investment = $0.067(2.4 \text{ circ. mil}^{-0.21})$

Interest and depreciation/year = $0.06 + 0.067(2.4 \text{ circ. mil}^{-0.21}) = (0.06 + 0.1608 \text{ circ. mil}^{-0.21})$

Annual fixed charges = $(0.06 + 0.1608 \text{ circ. mil}^{-0.21})(0.011895 \text{ circ. mil} + 246)$
$= 14.75 + 0.00071 \text{ circ. mil} + 0.00191 \text{ circ. mil}^{0.79} + 39.557 \text{ circ. mils}^{-0.21}$

Years (stranded) = $(0.00056 \text{ circ. mil.} + 160.5) \div (14.75 + 0.00071 \text{ circ. mil} + 0.00191 \text{ circ. mil}^{0.79} + 39.557 \text{ circ. mils}^{-0.21})$ (2)

Curves obtained by substituting various sizes of wire expressed in circular mils in equations (1) and

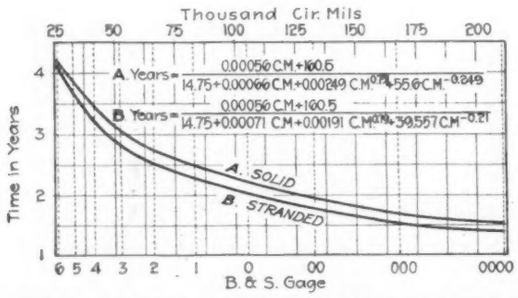


FIG. 5—WHEN IT PAYS TO TAKE DOWN IDLE WIRE

If the line is to remain idle longer than the period indicated it will pay to remove it at once and replace it when necessary. If the line must be used before this time it would not pay to take it down.

(2) are given in Fig. 5. They apply to only one general case where one given size of wire is replaced on the same pole line with the same size of wire, there being a time interval between the removal of the first wire and the installation of the second. There are naturally a great number of possible combinations of various sizes of wire being replaced by various other sizes, and for each case data and curves could be obtained. This one general case can only suggest what could be expected in all the others.

In this discussion there remains to be considered the economy of replacing with smaller wire large wire that is not loaded sufficiently. Here again curves could be obtained to show the length of time at which the interest and depreciation of the large wire would equal the interest and depreciation on the small wire plus the cost of installing and removing the large wire. It has been attempted here to indicate by one concrete example what is the correct point of view to take with regard to the working efficiency of copper wire on distribution systems, to furnish some definite assistance to the good judgment that is necessary for successful handling of all matters dealing with the future.

CONCLUSIONS

The curves of Fig. 5 tend to lead to the conclusion that not enough attention has been paid to the removal of wire when it is not effective in distribution systems and that a greater over-all efficiency would probably be obtained by doing away with idle wire or wire not working sufficiently. It is obvious that under present conditions, with the price of copper far above the average price formerly paid for the distribution system as a whole, and probably higher than it will be in the future, the removal of wire as suggested above is far more profitable than if all wire had been and would be purchased at the same price. At the same time it should be noted that a uniform price of copper at 30 cents was assumed in plotting the curves; thus the above gain was not taken into consideration and the proposition was not made so general as it could be.

DUCT SPLICING SAVES SHORT LENGTHS OF CABLE

How Splice Diameter Is Minimized—Tests Indicate Practicability of Splice—Extent to Which Duct Splices Are Used

BY J. B. NOE AND A. RABE
New York Edison Company

THE financial loss due to inability to utilize short lengths of cable is a serious one to all companies operating underground systems of distribution. These lengths are constantly accumulating owing to withdrawal of old cable necessitated by changes and replacements of existing circuits. Large companies doing a great deal of underground work keep these lengths and eventually can utilize them by matching in with new construction, but this involves keeping on hand a large quantity of slow-moving stock, tying up investment and often using valuable space for storage. Smaller companies usually are obliged to scrap their short pieces of cable, often at only a fraction of the original cost.

It has long been the practice to splice the shorter lengths of small cables, such as arc-light and main cables, to make up lengths that could be used, but a joint such as is usually made in large high-tension and low-tension feeders would be too big to draw into the standard-sized duct. It has doubtless occurred to many underground superintendents, however, that if a small enough splice could be made in such feeders much of

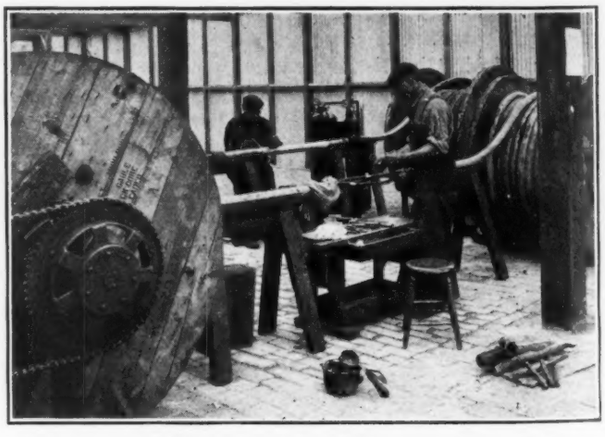


FIG. 1—DUCT SPLICES IN THE MAKING

The splice in the foreground shows the staggering of the individual conductor joints employed to minimize the diameter of the joint. In the background a man is lead-burning a split sleeve to the sheaths of two cables that have just been joined. Note small diameter of splice compared with cable.

this slow-moving or waste cable could be utilized. This possibility is of especial interest at the present time owing to the high cost of metals, difficulty in obtaining cable deliveries and desirability of releasing as far as

possible the full capacity of the cable factories for the manufacture of materials directly useful in the prosecution of the war. In view of these facts the long experience of one of the large lighting companies in the development and use of duct splicing may be of interest.

How Splice Diameter Is Minimized

The underground department of this company made such a splice in November, 1904, joining two sections of three-conductor, 250,000-circ. mil., 6600-volt cable. The diameter of the splice was kept down by staggering the joints in the three conductors, making a joint 24 in. (71 cm.) long, over which was placed a split lead sleeve slightly larger than the original cable, soldered at the seam and wiped to the cable sheath at the ends. This joint was made by drawing in the first section, making the splice in the manhole, and then resuming the pulling, drawing the splice and second section on into the duct. This original duct splice remained in service without failure for several years and when finally withdrawn for some cable changes was opened and found perfect.

Prior to 1911 no great difficulty was experienced by this company in utilizing short lengths of feeder cable, the large amount of construction work continually in progress providing a comparatively ready outlet for such material. In this year, however, the size of the standard high-tension feeder was increased from 250,000-circ. mil. round conductor to 350,000-circ. mil. sector, all new cable purchased being of the latter size. As a result large quantities of the smaller-size cable began to accumulate in the stockyard, it being impossible to match in the short lengths of old cable as parts of new feeders as had been the previous practice.

In the same year the proposed addition to the system of about twenty-five high-tension service connections offered a tempting opportunity for the use of this cable, provided that it could be spliced up to make such lengths as could be used in existing subway. Duct splices similar to the one made in 1904 were successfully utilized, and all these connections, involving the use of more than six miles (9.7 km.) of feeder, were made, using this old cable exclusively. Not one failure has ever occurred in any of these splices or on any of the more than 600 duct splices made on various cables.

During the next few years very extensive changes in the underground cable system due to starting up a new generating station provided an ample outlet for released cable, but in 1915, the accumulation of short lengths again becoming critical, serious attention was turned to the duct splice. Before adopting it as a permanent policy for all types of cable, tests were conducted to determine:

First—Mechanical strength, both of the spliced sleeve and the spliced conductor, as compared with the strain put on them in installing and withdrawing the cable under the severest duct conditions.

Second—Dielectric strength of the duct splice after it had been subjected to the strain of installation.

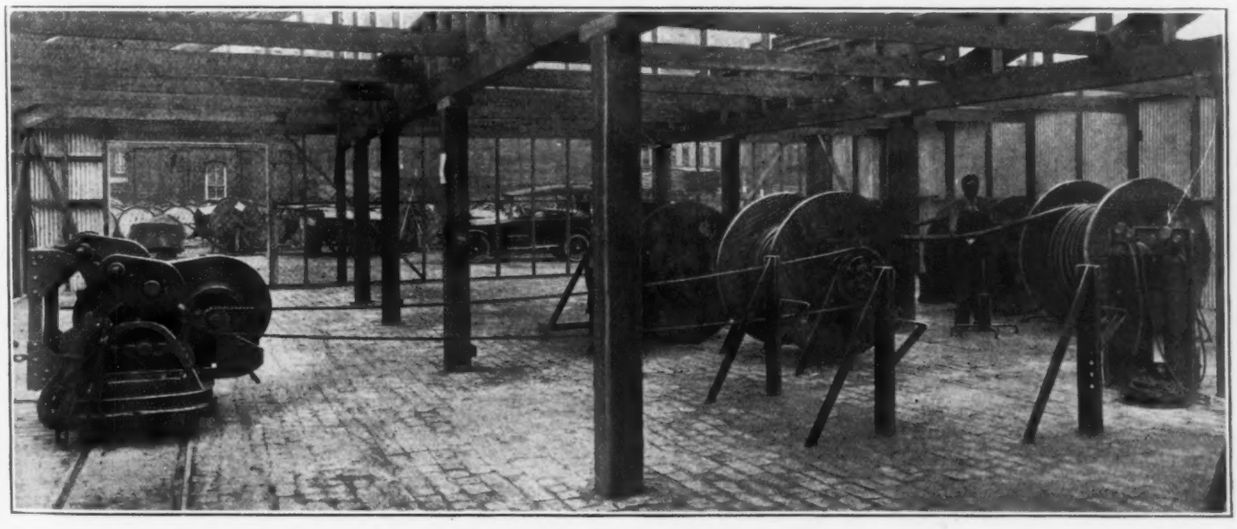
Third—Heating in the duct splice due to heavy loads.

All of these tests showed the duct splice as made up to be superior to the body of the cable.

A decided improvement was made at this time by "burning" on the lead sleeve instead of using solder. This made the joint as flexible as the rest of the cable, and as the spliced lengths could be put upon reels without fear of cracking, it became the practice to make the joints in the cable yard instead of in the manhole, effecting a very great saving in cost. At odd times and on rainy days the short pieces were spliced up to make sections of such lengths as could be easily matched.

During 1916 a duct splice was developed for two-conductor, 1,000,000-circ. mil low-tension concentric cable with three pressure wires. Large quantities of slow-moving stock of this type of cable were thus made available for immediate use.

Among the various types of cable on which the duct splice has been used, two deserving of special mention are triplex 350,000-circ. mil, 25,000-volt armored submarine cable and single-conductor 2,500,000-circ. mil low-tension cable with pressure wires. Of the first type three 910-ft. (277-m.) reserve lengths were made available for immediate installation as four 610-ft. (186-m.) lengths by cutting and splicing. Of the latter type 2100 ft. (640 m.) left dead in the subways by



GENERAL VIEW OF CABLE-SPLICING HOUSE

In this room short pieces of cable are spliced into continuous lengths and reeled for future use. At the left is a carriage bearing a geared-down motor which may be connected with any reel in the house by sprocket and chain. Note gas tanks for burning cable sleeves and V-shaped mirror under cable by which inspector can examine physical conditions of all sides at once.

the starting of a new substation were salvaged and are now installed as direct feeders to a new large customer.

Some idea of the amount of cable transformed from scrap or very slow-moving stock to actual service may be gained from the fact that the company previously referred to has to date a total of 211,569 ft. (approximately 64,460 m.) of duct-spliced cable of various types, representing a value of approximately $380,000. Practically all of this material is now installed.

Splicing Done in Cable House

The work of making these special splices was at first done in the cable yard, temporary tarpaulin shelters being erected for protecting the exposed ends of the cables from rain, snow or whatever necessary. As the work assumed larger proportions it was decided to erect a building with special facilities for handling the reels expeditiously and with a minimum of labor. A narrow-gage track enters this building from the point where the reels are delivered by truck and runs the entire length of one side. The reels are placed on small cars running along the track, from which they can be delivered to any of the six splicing stations. At each of these stations are two specially designed cable racks to hold the reels, the splicing being made between the racks. An electric motor with suitable speed control has been mounted on a car, and by means of a sprocket and chain connection can be used to reel or unreel cable on any of the racks. Only one man is required for this work instead of the usual gang of four or more. A convenient system of piping makes easy the connection of the oxy-acetelyene outfits used for the lead burning at each of the splicing stations, thus avoiding a multiplicity of tanks.

Very little expense for material was incurred in the equipment of the splicing house. Much of it was rescued from the scrap heat, and some, such as the rails of the narrow-gage railway, was purchased from contractors at practically its scrap value.

While it would not be necessary for all companies using cable to prepare such an elaborate plant for duct splicing as the one described, it is obvious that all companies generally can adopt with great advantage the practice of making such duct splices to save considerable cable material that would otherwise be scrapped or kept in slow-moving storage.

Central-Station War Service

Analysis of Power Load of Representative Company Shows that More than 90 per Cent of the Energy Delivered to Motors Is for War Material Production—Nine Routings for Power Supply to Industrial Plants

UNTIL the war is over nothing like a full account of what the modern central station is doing to help win the great conflict for democracy and liberty can be prepared for publication; but when the inside story becomes known the entire electrical industry will be proud of its record. War to-day is a conflict between entire nations and not only a series of campaigns against armed enemies. An organized, efficient producer and distributer of electrical energy is therefore one of the most valuable resources of a community engaged in the manufacture of munitions and other supplies for war use. More and more, industry is going upon a war basis, and steadily the demand upon the central station increases in this connection. In some cities the supply of power to war customers is now so large a part of the business that the management of the local central station has comparatively little time for the consideration of any other outlets for his plant capacity, if, indeed, he is not looking anxiously into the future and wondering how and when he will be able to secure additional equipment to meet forthcoming war industrial requirements and whether, when such equipment is installed, the supply of fuel will be sufficiently continuous to enable him to give 100 per cent service.

President Wilson and other officials of the government have gone on record on behalf of the central station's essential service, and many of the leaders of the industry appreciate to the full the important part the electric utility company is playing in efficient war material production. Many central-station employees, however, scarcely realize the scope and variety of this service or the close connection between the way in which they do their daily work and the "carrying on" of the country's war activities. For this and other reasons it is of interest to examine the war service work of a central station in the East now supplying energy to a city of about 200,000 population and which recently through its power sales department made a survey of the so-called "war load."

This investigation was undertaken last December as the coal situation became more and more threatening, and was primarily intended to anticipate curtailment of power, especially to factories not engaged in war material production. The following questionnaire was sent at this time to the company's larger power customers:

"In order that we may have on hand a record of companies doing government work, will you please send us the following information:

"Government Contracts.—(1) Contract numbers; (2) date; (3) material; (4) percentage of factory output.

"Government Sub-Contracts.—(1) With whom (name and address); (2) contract number and date; (3) subcontract number and date; (4) material; (5) percentage of factory output."

The response was very gratifying, for practically every questionnaire sent out was returned with the desired information, thus showing the hearty co-operation of the manufacturers, who realized only too well what a shut-down of their power would mean.

These questionnaires were classified by the power sales department, and a complete survey was made of all power customers of the company. The customers were divided into the following classes:

1. Factories devoted to war industries.
2. Factories devoted to war essentials and public necessities.
3. Non-war industries.

Under Class 1 were placed all customers who are actually engaged in war work, such as manufacture of ammunition, ammunition trucks, gun platforms, gun-mount parts, shell tools, torpedo equipment and other ordnance; textiles, such as tent tops, blankets, army woolens, and equipment for the emergency fleet, including machine manufacture of all kinds. Practically every department of the government was being supplied with material from these different factories.

Under Class 2 were included such war essentials as meat and provision factories, wholesale food producers, public utilities such as telephone, telegraph and gas companies; public schools, daily papers and the necessary lighting for police protection in the city.

Under Class 3 were included such non-essential industries as those of wall-paper manufacturers, printers, department stores, brewers and liquor sellers.

These classified data and the connected load of each customer were taken from the latest available records of the central station, and the kilowatt demand (fifteen-minute) was taken from the demand-meter record of each customer. Whenever there was any doubt as to the classification of a power user his load was placed in the lower class. This assured the central station of a conservative estimate of the power output for government work, enabling each case to be taken up individually in case of curtailment.

Results of Classifications

The results of these classifications may be summarized as follows:

Class	Number of Customers	Hp. Connected	Percentage Connected Power
1	129	20,598	67.9
2	185	6,780	22.4
3	154	2,941	9.7

From this it appears that 90.3 per cent of the total connected power load is devoted to war industries and war essentials. Forty-seven representative factories in Class 1 have a total arithmetical demand sum of 9994 kw. and a connected load of 17,620 hp. This is an average of 376 hp. per customer, with a demand per customer of 0.568 kw. per horsepower connected load.

In Class 2 seventeen representative customers, with a total connected load of 3692 hp., have an arithmetical demand sum of 1677 kw., an average connected load of 217 hp. and a demand of 0.454 kw. per horsepower connected.

In Class 3 eight representative customers, with a total connected load of 1168 hp., have an arithmetical demand sum of 522 kw., with 146 hp. average connected load and a demand of 0.447 kw. per horsepower connected.

This indicates that the factories devoted to war work are pushing their mills harder than those on the so-called non-essentials.

Inasmuch as 74 per cent of the total station output is power and 90.3 per cent of connected power load is devoted to war work or the war essential industries, it follows that 67 per cent of the total station output is devoted to the war industries.

On the basis of the above classification, the average monthly output devoted to war work is 3,100,000 kw.-hr. out of a total of 4,000,000. The latter includes power, commercial, residential and street lighting. The installed capacity of the station at the time of the survey was about 40,000 kw.

This plant, like many other central stations, is so tied in with other reliable and interconnected sources of power that an adequate supply is assured at practically all times. In the city where the above analysis was made there are no less than nine different routings by which power can be supplied to the customers in the event of a partial shut-down of any of the substations. In other words, the power service of this company has as many lives as the proverbial cat!

Preliminary studies of the individual loads in these war industry plants indicate that the diversity factor is between 1.5 and 2. In some cases the load conditions are unusually good.

It is significant that this station, in negotiating at present for additional power loads, finds upon a conservative estimate that 89.5 per cent of the new "prospects" are devoting their energies to war industries.

Based on an average isolated mill-plant fuel consumption of 4.5 lb. to 5 lb. of coal per horsepower-hour, this one central station is saving the country and its allies about 3500 tons of coal per month in supplying power to war industries alone, and through its interconnection with other systems not only is the service safeguarded, as mentioned above, but the use of fuel within the various connected plants is kept down to economical limits. Although over sixty employees of this company are with the colors, the foregoing data prove that not all the patriotic service of the central-station personnel is being performed in uniform. The priority rights of the central station in the matter of fuel, equipment and material supply are very much in evidence in the face of such facts as the foregoing. The central station is doing its part splendidly in the great cause to which the uttermost resources of the civilized world are being summoned and dedicated, and every faithful employee shares in the honorable performance of this high and responsible duty.

Tungsten Patent Suit Dismissed in England

A reserved judgment, dismissing the appeal of the British Thomson-Houston Company against an order of the Court of Appeal confirming the judgment of Justice Astbury in favor of Durham, Ltd., has been delivered by the House of Lords of England. The issue was whether a patent for the treatment and working of metallic tungsten was valid.

The main object of the patent on which the present action was brought was to manufacture the filaments by drawing the tungsten in the form of wire.

The Lord Chancellor was unable to read the words "the metal in a coherent form" as meaning tungsten which had been subjected to appellants' preparatory process as described in the specification.

Appellants further asserted that the application of heat, especially of continuous heat during the process of working, showed invention and was good subject-matter. There could be no subject-matter in the application to tungsten of the old process of working under heat. The claim was merely for subjecting the metal to the action of heat while it was being worked, and the operator was left to find out by experience what were the necessary precautions.

War's Influence on Central-Station Selling

Changes in New-Business Methods Forced by Prohibitive Cost of Extensions—Getting More Business from Existing Customers—Eliminating the Carbon Lamp and Furthering Use of Appliances

THE great war has brought many influences and counter influences through the past year that have affected central-station policy and practice in many ways. In no department, however, have these war-time conditions been more far-reaching in their contact than in the field of selling. The national concentration on the winning of the war has begun to warp the daily lives of all the people and is naturally reflected in their dealings with the central station. As they react to their increased prosperity or greater caution in the fact of the uncertainties of the times, the central station feels it promptly. The industry, therefore, has step by step been adjusting itself to each new factor in the market, working carefully to maintain a balance between the present higher costs and physical restrictions in doing business and the natural desire to render service to the utmost.

The first great change which the war demanded came in the matter and manner of taking on new business. The steadily mounting cost of copper and other materials soon reached a point where the expense entailed in making an extension to connect a new consumer was more than the business was worth. At the same time conditions in the money market made it practically impossible to finance any further investment of the sort, and as a measure for the conservation of capital there has been a general embargo declared against new business. The degree to which it has been necessary to apply this restriction has, of course, varied widely with conditions in the city.

Providing Power for War Industries

Naturally, the most pressing obligation is to provide the power needed for industrial uses so essential to the winning of the war. Whenever there has been so great a demand that the capacity of the station has been hard pressed, active measures have been taken to protect the vital industries at all cost. In Seattle, Wash., Worcester, Mass., and several other cities the co-operation of local manufacturers was actively secured and a better distribution of the load effected through slight changes in the hours of starting and quitting and other rearrangement of the power uses. In Springfield, Ohio, a meeting of the leading local business men and manufacturers was called, at which the central station laid the matter before them and said: "Here is the power that we can provide. How shall we apportion it among you to best advantage?" In the face of the practical impossibility of securing additional station capacity without conflicting with the government's huge need for electrical machinery of every kind such measures have been very helpful.

Even where the capacity has been safely available the prohibitive cost of extensions has been met by requiring the customer to finance the cost himself. The Cleveland Electric Illuminating Company, for instance, established a form of contract under which the customer advanced the cost of construction, and the normal cost, that is to say, the cost as of July 1, 1914, is returned to the consumer in periodic payments. This plan has been applied with varying details by many companies, some restricting all new business to locations along existing lines and others further holding it down to loads of definite characteristics. The Commonwealth Edison Company of Chicago and the Public Service Company of Northern Illinois petitioned the Utilities Commission to suspend the rule covering extensions for the period of the war. All the subsidiary companies of the Eastern Power & Light Company and General Gas & Electric Company announced to the public that as a war conservation measure no further extensions or connections would be made. These cases are typical.

With this general policy in force the selling effort has resolved itself into the development of more and better business from existing customers, both through the sale of household heating and power appliances to residence consumers and more motors to the industrial field; and in both directions the war itself has actively created market. The higher costs of living in these times and the growing scarcity of domestic servants have wrought a revolution in the attitude of the average housewife and her husband toward investing in modern home efficiency equipment. A good example is reported from Elmira, N. Y., where two large local industries advertised for women and within a few weeks took several hundred out of domestic service. This meant that hundreds of housewives were suddenly obliged to do their own work, and there came an immediate demand upon the central station for all kinds of electric household appliances to help them do it. The growth in power business, of course, has been tremendous owing to the general speeding up of industries all over the country under the impulse of war work.

Under these conditions there has been great opportunity for awaking the public to the value of electric service for saving time and labor in the home as well as in the factory, but not all central stations have taken advantage of the situation to build up the load along existing lines. Campaigns for the sale of cleaners and washing machines and other appliances where held have been particularly productive.

Straightening Out the Price Policy

The outstanding feature of this whole merchandising movement by central stations, however, has been the almost universal straightening out of the policy of price. Under the influence of the times it has been possible to increase prices without fear of the public misunderstanding the reason for it. Higher costs are forcing higher prices in all lines, and the revision of resale schedules necessitated by the raising of the manufacturers' list has brought to many companies the opportunity to bring an end to cost selling practices which had been robbing them of proper profits in the past. The old idea of embracing almost everything the customer required under the head of service, and looking

to the sale of energy to pay for it, has been made more difficult under war conditions.

As a result, a much healthier condition has been developed in the field of merchandising. The urgency of the need for holding down investment and decreasing the expense of maintaining the new business department has demanded more profit from sales and has gone far to rectify the old mistaken policy of selling goods too cheaply in order to get them on the lines. In addition many companies have instituted charges for all work done by troublemen on the customer's premises. In Rochester, for instance, when a man goes out on a "lights out" complaint, a charge of 25 cents is made for the call plus the retail price of the fuses installed, provided, of course, that the trouble was in no way the fault of the company. All this has greatly improved the position of the central station in its purely business dealings with the public, placing its scale of compensation more nearly on a basis of value received.

Over-long periods and easy-payment terms formerly offered in the sale of appliances have also been corrected in some cities at the same time. Also, as in New Orleans, the work of eliminating the carbon lamp has been taken up under the plea for war-time efficiency, and a most successful effort made to convert all consumers to the use of tungsten lamps. This, of course, is particularly timely. The idea appeals to the public as a further way to save and at the same time offers an immediate benefit to the central station by reducing the cost of lamp renewals. In Houston, Tex., an annual saving of about $700 has been effected in this way. Such campaigns, supported by the sale of tungsten lamps at list, have been found well worth while.

This practice of pricing lamps at list, by the way, has been steadily growing under the influence of the times, and bids fair to continue to spread. In connection with this educational effort to extend the use of tungsten lamps many utilities have advertised broadly the need for conserving power and urged the public to exercise care in the use of light, turning off all lamps when not in actual use.

The Ever-Present Labor Question

One of the first reactions from the war affecting the central station was, of course, the labor situation, and this has brought a difficult problem which is being met in many ways. The sales department staff is usually composed of young men, and the number of these salesmen who have left to join the national forces has been large. There has been a tendency not to replace these men but rather to curtail the work of the department and save that much expense, and in fact often companies have transferred the members of their commercial departments to fill other jobs elsewhere and in these cases have practically discontinued all selling work. They feel that at this time they can better afford to drift with the current of their growing business and save the cost of salesmen's salaries. A practical alternative, however, has been applied in other cases by shifting the selling force onto a commission or salary-plus-commission basis, under which each man can prove himself self-supporting and therefore profitable. The Doherty companies have been operating on this plan for some time, and under the stimulated demand for appliances sales and profits have grown.

The profitableness of sales activities has been further increased by the fact that the men have been concentrating along existing lines in the effort to fill up the valleys of the load by selling more motors and appliances to present customers. This work in many cases has taken the form of special campaigns on the high-priced motor driven appliances, like the washing machine, the dish washer and vacuum cleaner, which, while adding little to the load, pay a generous profit.

Small Economies Being Sought

But this is only one of the broad problems of administration where, under the spur of urgency, chances for new efficiencies in the operation of the business side of the central station have been discovered. The need has been to get along with fewer men and save as many dollars in as many ways as possible. Combination companies have found that they could save by having both gas and electric meters read by the same man, by billing for both on the same card, by having the same wagon set both meters, and, in short, eliminating duplication right down the line in its dual relations with the customer. Delayed meter-reading cards have been introduced which the reader slips under the door when he is unable to gain access to the premises, asking the consumer to indicate on a printed dial the reading of his meter. This saves many second calls. Systematic canvasses have also been made of all installations where more than one meter is in use, and many cases have been found where a single meter would suffice. This has not only restored a meter for service elsewhere but has brought a saving in the entire routine, from the reading to the paying of the bill.

It is in these innumerable small economies that the best results have been obtained in tuning up the system to a higher efficiency. The use of women and old men for meter reading has been tried out most successfully. Schoolboys have been adopted for delivering bills in Sandusky, Ohio, after very careful experiment, and their use is spreading—as is the use of women bill deliverers. This frees man-power for other work and at the same time cuts the cost appreciably. By changing over from the end-of-month to continuous meter-reading system it has also been possible to do the work with fewer specialized employees, and in Leavenworth, Kan., they are successfully trying the experiment of having the customer apply for his own bill when he comes to pay the money during the discount period. It is believed that this will reduce the cost and detail of bill delivering to a very small minimum. These and other measures for reducing delinquency and short-cutting the detail of reading, billing and collecting have received attention everywhere and have borne good fruit in small economies. A general appeal to the public to pay bills promptly in consideration of the times has brought response in almost every city.

The past year of war, therefore, has been a period primarily of business housecleaning among the central stations. Not only has the dead stock been brought out of storeroom corners, bargain-priced and sold to turn this dead investment into coin, but all those small details of administration system left in normal times to run themselves have been gone over with a fine comb with such results as have been enumerated. Matters of interrelationship with the local contractors have received a growing consideration, and in many cases a better degree of working harmony has been effected.

Present Status of Brass Melting—II*

Relative Merits of the Different Types of Electric Furnaces That Are Now Upon the Market—Only Two of These Have Been Found to Be Suitable for Use with Alloys That Are High in Zinc

BY H. M. ST. JOHN
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Four types of electric furnaces are in commercial use for melting copper alloys. Of these only two are suitable for use with alloys high in zinc. One, the vertical-ring induction furnace, operates at high efficiency, but is somewhat limited in its application and not sufficiently flexible for general foundry use. Within its limited range it appears to be giving very satisfactory results. The indirect-resistance, indirect-radiation furnace is less efficient and has a lower rate of production in proportion to its holding capacity, but is more flexible and better suited to general foundry use. Neither of these furnaces can be classed as altogether satisfactory, but each is serving a useful purpose.

The indirect-arc furnace is in use for melting alloys which contain small percentages of zinc and those which contain no zinc at all. It is more efficient than the indirect-resistance furnace and, within its field, more flexible than the induction furnace.

The direct-arc furnace is being used to a limited extent in melting copper alloys which contain no zinc. Present conditions make its use profitable in some cases, but its continued application for this purpose is not assured.

THE obvious method of reaching a high thermal efficiency without overheating an alloy is to generate heat in the metal itself by the passage of an electric current through it—either by a direct resistance furnace, in which electrical contact with the metal is made through electrodes, or by means of an induction furnace, in which case the metal forms a complete circuit for the flow of an induced electric current, without the use of electrodes. In either case it is practically necessary to establish the circuit through molten metal previously melted in some other furnace.

The "pinch-effect" direct-resistance furnace was the first type in which this principle was utilized. Virtually all of the heat is generated in the molten metal temporarily occupying channels or tubes. The main portion of the metal, occupying the furnace chamber above, is heated by contact with the hot metal, and solid metal added to the bath is melted by the same means.

The stirring action of the moving streams of metal is vigorous, and the temperature of the main portion of the bath rises uniformly. There is no difficulty in restraining the vaporization of zinc, and, in fact, it may be said that the metallurgical requirements of any single alloy are almost perfectly fulfilled.

Generation of heat in the metal itself, where its presence is desired, is theoretically ideal from the standpoint of efficiency, since no part of the furnace is any hotter than the metal, and wall losses are reduced to a minimum. With this type of furnace, however, the massive metallic electrodes require a considerable water cooling. Consequently a large quantity of heat escapes from the furnace, and the thermal efficiency is much lower than it would otherwise be. Considerable difficulty has also been experienced in constructing satisfactory transformers for use with the extremely low voltages and high currents required. So far as is known to the writer this furnace is not now used extensively.

The next step in the development of electric furnaces was the application of a similar principle to the induction furnace. In this the use of electrodes and troublesome transformers is avoided, since the furnace serves as its own transformer. The generation of heat takes place as before in the resistor channels, and the same vigorous circulation of metal results. Whether this action is due primarily to the pinch phenomena or to a motor effect resulting from the flow of current through the continuous molten resistor is open to question. It is difficult to tell where one phenomenon leaves off and the other begins.

The thermal efficiency of the induction-type furnace, operating, as it does, without electrodes, is very high, probably higher than that of any other electric furnace ever tried out for copper-alloy work. Its metallurgical characteristics are also excellent. It offers a perfectly steady, uniform load at a power factor which is satisfactory, at least in the relatively small sizes so far built, the largest requiring a 60-kw. input and pouring 600 lb. of metal per heat. In larger sizes there might be trouble with low power factor, as is so frequently the case with large induction furnaces.

The induction furnace is in commercial use and is said to be giving satisfactory results. It has, however, pronounced limitations which are partly inherent in its design and partly remediable. Its small size is one disadvantage, but it is probable that somewhat larger sizes can be successfully built. So far it has not been found practicable to use the furnace with alloys high in lead, because that metal has a tendency to penetrate minute cracks in the lining of the resistor channels, causing short circuits. The remedy for this is the development of a lining especially suited for use with lead.

Limitations of Induction Furnace

The more serious limitations of the furnace are its lack of flexibility in changing from one alloy to another and the practical necessity of operating it continuously, never allowing the furnace to cool oftener than once a week. The length and cross-section of the resistor channels are especially designed to accord with the electrical resistance—in the molten state—of the alloy which is to be used. These same resistor channels cannot be employed with another alloy of widely different resistance, which, accordingly, requires the installation of new channels of properly modified design. In changing from one alloy to another, even if the resistance is approximately the same, it is necessary to pour the furnace clean and start with a molten charge of the new alloy, melted in another furnace.

The linings of the resistor channels stand up very well under continuous use but deteriorate rapidly un-

*See article by same title in June 1 issue.

der the daily heating and cooling of ten-hour-day operation. This can be obviated by maintaining over night sufficient power to keep the channels filled with molten metal, which, of course, results in some addition to the cost of operation.

The limitations mentioned tend to prevent the use of this furnace in commercial foundries, which melt a wide variety of alloys and do not work nights, but form no bar to its use in yellow-brass rolling mills, to the purposes of which it seems well suited.

There has been proposed a new design of induction furnace which would not be subject to the foregoing limitations. In this type a spark gap and an arrangement of condensers connected in series and in parallel are used in the primary circuit of the furnace, which operates at about 10,000 volts and some 15,000 to 20,000 cycles. The secondary of the furnace consists of a crucible or melting chamber with electrically conducting walls. The metal within the crucible also carries part of the secondary current, to a minor degree when it is first charged in the form of solid pieces, to a much greater degree when it becomes molten. The primary circuit is arranged around the melting chamber and is separated from it by suitable refractory and heat-insulating walls. The furnace is, in a sense, an eddy-current rather than an induction furnace, since no iron cores are used and the metal itself, lying in a circular pool, completely short-circuits what, in an induction furnace, would be called the secondary circuit. This unique arrangement is made possible by the exceedingly high frequency used.

According to last accounts, this furnace had been built only in very small sizes, capable of pouring not more than 45 lb. (20.4 kg.) of metal per heat. There is no apparent reason why the metallurgical characteristics should not be good, and the construction of the metal-containing portion of the furnace is desirably simple. It is obviously unnecessary to use molten metal in starting the furnace. Any alloy or even non-conducting material, such as glass, can be melted without changing the furnace design. The furnace is suitable for intermittent operation and need not be kept hot overnight.

Arc Furnaces

Next to the methods already described the most direct way of applying heat to the metal is by means of a heat source outside but in direct contact with the bath. The direct-arc furnace is the only type which utilizes this principle.

The application of direct-arc furnaces to copper alloy melting has been rather limited. One or two furnaces designed for steel melting have been tried, but no new type of direct-arc furnace has been developed for this specific purpose. No furnace of this general type has ever succeeded in satisfactorily melting yellow brass or other copper alloys containing an appreciable percentage of zinc. The high-temperature heat source in direct contact with the bath overheats the metal in its immediate vicinity and always causes excessive loss of zinc.

With copper alloys containing no zinc conditions are somewhat different, since lack of uniformity in heating is less likely to result in serious loss. In a direct-arc furnace of small size it has been found possible to melt a copper alloy containing as much as 15 to 20 per cent lead with less loss than is commonly the case with the same alloy in fuel-fired crucible furnaces. In larger furnaces the greatly increased rate of heat input supplies heat to the metal in the neighborhood of the arc more rapidly than it can be conducted away to more distant portions. As a result the surface of the metal becomes overheated while other parts of the bath are still much below the desired temperature.

Advantage of Direct-Arc Furnace

The direct-arc furnace has the advantage of simplicity and high thermal efficiency. Its design has been more highly developed and perfected than that of most other electric furnace types. Since it is so widely used in the steel industry, several reliable and readily available furnace designs are on the market. It is very doubtful, however, if any direct-arc furnace deserves wide application for melting copper alloys. Its use is limited to only a few of the common alloys, and, if large units are employed, the metal loss, even with these alloys, is likely to be serious. Small units are more satisfactory in this respect, but are subject to the disadvantages of lower efficiency, higher fixed charges and higher operating costs per ton of metal produced.

Such direct-arc furnaces as are now in use in this field—and there are a few—hold their place by virtue of their simplicity, their elimination of crucible cost and their high rate of production, at a time when these qualities are at a premium.

The intensity of heat application to the metal is lessened somewhat by using an arc between two or more independent electrodes above the bath, heating the latter by direct radiation. This is the principle of the usual type of indirect-arc furnaces. The arc does not come in direct contact with the metal, and the latter forms no part of the electric circuit. It is apparent that in this type of furnace the surface of the metal is not so seriously overheated as in the direct-arc furnace, but such overheating as exists is, nevertheless, too severe to permit the use of such furnaces in melting yellow brass. The indirect-arc furnaces can be used economically with alloys containing 5 to 10 per cent of zinc, possibly as high as 20 per cent, but certainly not for higher values.

The design of the indirect-arc furnace is invariably somewhat more complicated than is the case with the direct-arc furnace, and its thermal efficiency is not so high, but in the melting of copper alloys it can be economically used in large units and seems to be in general a more satisfactory tool for the purpose.

Several indirect-arc furnaces are now in use in this country for melting copper alloys which contain small percentages of zinc or none at all. In a new type of indirect-arc furnace the metal, as soon as it becomes molten, is agitated by rocking the furnace mechanically, in order to avoid overheating of the surface layer. In this way non-uniformity of heating is largely rectified, and it is possible that alloys high in zinc can be melted without excessive loss. The furnace has received a comprehensive commercial test, the results of which will be published soon. This type gives considerable promise of success and should be applicable to a wide field of alloy melting.

Indirect Resistance Furnaces

Resistance furnaces which do not utilize the metal itself as an electric resistor may be grouped in three

classes—(1) those which radiate heat directly to the metal, similar in principle to the indirect-arc furnace; (2) those which radiate heat to the furnace roof and thence to the metal by reflection and secondary radiation; (3) those which deliver heat to the metal by conduction through a refractory wall.

Heating by direct radiation is the most desirable of the three from the standpoint of efficiency. For this purpose it is practically necessary to support the resistor above the bath in some manner, and this has never been done successfully in furnaces of any size. In small furnaces it has been possible to utilize this principle and to melt brass satisfactorily without overheating the surface of the metal to an undesirable degree, since, as compared with an arc, the resistor has a large area and operates at a much lower temperature. At the same melting speed the application of heat to the metal is more uniform but the efficiency is somewhat less.

MECHANICAL DIFFICULTIES PREVENT COMMERCIAL USE

This type of furnace is applicable to the melting of yellow brass but is not in commercial use because of the mechanical difficulties involved in its construction. The possibility of its eventual use depends upon the development of a resistor material which is at once highly refractory, homogeneous, mechanically strong at high temperatures and possessed of a fairly high electrical resistance at the working temperature of the furnace.

The second type of indirect resistance furnace named ranks next in order of thermal efficiency. In this design a refractory wall separates the resistor from the metal, although not necessarily in contact with the metal, and the major portion of the heat is radiated from the resistor to the furnace roof, the latter acting as a secondary heat source which reflects and radiates part of the heat which it receives to the bath beneath it. The heat has to travel a rather long path, and much of it is lost by the wayside. As a result the furnace is not so efficient in principle as those previously discussed. In order to stimulate a reasonably rapid flow of heat the resistor element must be much hotter than the roof, and the roof, in turn, much hotter than the metal. Thus the possibility of a high rate of production depends upon the use of a resistor capable of operating at a temperature very much above that of the metal, even at the pouring point. The furnace roof must be exceedingly refractory, and the brickwork in the immediate neighborhood of the resistor must be even more refractory than the roof.

This furnace, in common with other indirect resistance furnaces, has another disadvantage, somewhat minor in character but worth considering, which does not exist with direct-resistance furnaces, nor to any great degree with arc furnaces. The heat storage of the furnace is large and the stored heat is at a higher temperature than that of the metal. Consequently, the temperature of the metal will continue to increase after power has been shut off so that the metal must be poured promptly when it has reached the desired pouring temperature in order to avoid overheating.

This is the only form of indirect resistance furnace which has been used commercially for melting copper alloys. In its present form it is simple, reliable, easy to operate and can be used for practically any alloy, with either intermittent or continuous operation. Its metallurgical characteristics are excellent, with the single exception that it is somewhat difficult to secure thorough mixing. It is also especially suitable for melting alloys high in zinc. However, its production rate is not rapid and it is not so efficient as the types of furnaces already described.

A similar type of furnace exists in which a combination of arcs and resistance elements is utilized, all radiating heat to the furnace roof, which, as in the furnace just described, serves as a secondary heat source. The use of arcs makes possible a considerably higher power input, more rapid melting and probably a slightly more favorable efficiency, provided that a sufficiently refractory roof is used. A very high efficiency cannot, however, be expected from this type of furnace. Certain difficulties in furnace design have been encountered which have so far postponed the commercial use of this furnace. It has been under test for some time, but the results obtained have not yet been made public.

The least efficient method of transferring heat from its source to the metal is to force it through a refractory wall, even though this wall be that of a clay-graphite crucible, a mixture which has a fairly high heat conductivity. Theoretically, the least undesirable arrangement under these conditions is to inclose the resistor in the refractory wall or to use the wall itself as a resistor. In the latter case the wall must be separated from the metal by an insulating layer to prevent short-circuiting. It is not an easy matter to make this insulation permanent, so this factor has been a serious source of difficulty. A resistor inclosed in a refractory wall tends to reach excessively high internal temperatures, and no material, satisfactory in other respects, has yet been found which will not destroy itself under these conditions. Another troublesome difficulty results from the ease with which most resistor materials unite chemically with the furnace refractories at high temperatures, thereby destroying both themselves and the refractories. Some two or three furnace types have been designed to make use of this principle, but they have been collectively unsuccessful. At present there is no real activity along this line.

CRUCIBLE FURNACE LOW IN THERMAL EFFICIENCY

Finally, it is possible to melt brass in a crucible by means of resistor elements which surround but do not touch the crucible. Perhaps the most perfect results, from a metallurgical standpoint, can be obtained in this manner, but the thermal efficiency is at a minimum, and in any case the electric crucible furnace lacks most of the secondary advantages upon which the electric brass-melting furnace must depend in part for its successful use. In cases where perfection of metallurgical results is by far the most important consideration it is possible that an electric crucible furnace can be employed profitably, but, so far as is known to the writer, no commercial installation of this kind exists.

So far as thermal efficiency is concerned, the crucible furnace takes its place at the bottom of the list. Its energy consumption per ton of metal produced is about three times that of the induction furnace. One or two attempts have been made to improve the efficiency but owing to the facts just stated its development has been discontinued.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Elementary Principles of Continuous-Current Armature Winding.—F. M. DENTON.—A continuation of the article classifying and explaining the nature of the various classes of continuous-current armature winding. The symbols used to designate the various windings, the choice of type of winding, effect of re-entrancy, definitions and winding rules are given in this section.—London *Electrician*, April 5, 1918.

Generation, Transmission and Distribution

Iron Wire for Transmission Lines.—W. T. RYAN.—The author deals with the cost of conductors and the relative advantages of iron and copper, quoting Kelvin's law for maximum economy. He points out that there is difficulty in determining the relative advantages of iron and copper on alternating-current circuits because the alternating-current resistance varies widely with the current and grade of wire. For long extra-high voltage lines aluminum is sometimes cheaper than copper. The Germans are reported to have discovered an alloy of zinc which combines ductility and toughness with fair electrical conductivity. In some cases they have even used iron wire covered with a double coating of varnish instead of the ordinary form of insulated wire. The article includes several curves.—Paper read before the Minnesota Electrical Association.

Transmission-Line Practice; Construction and Costs.—LIEUT. E. T. DRIVER and E. V. PANNELL.—The chief problems of engineering at the present day are economic ones. The different factors which affect cost in transmission-line work may be briefly summarized as follows: (1) Right-of-way, (a) easements or purchase, (b) clearing; (2) surveys and engineering; (3) material, (a) tower steel, (b) conductors and ground wire, (c) insulators, (d) hardware and equipment; (4) labor, (a) distributing material, (b) digging holes, (c) erecting, (d) setting insulators, (e) stringing wire and cleaning up; (5) interest; (6) contingencies. These factors are discussed. The article includes two charts showing metal costs.—Toronto *Electrical News*, May 1, 1918.

Installations, Systems and Appliances

Operating Features of Motor Drive in a Bakery.—The application of electricity for industrial cases and use for central-station service is coming more and more into use in various industrial plants. It is apparent that in a bakery the cleanliness and regulating features that can be had by the use of electricity are very great advantages.—*Electrical Review*, May 4, 1918.

Relation of Load Factor to Operating Cost of Electric Drive.—D. R. SHEARER.—Some of the factors which govern electric rates are the maximum demand for a specified period of time, the time during which the peak occurs, the time duration for the desired class of service, the actual amount of electricity consumed over a stated time, and the power factor of the load if alternating current is used. All of these factors may be determined mechanically. The economies of different methods of drive, the questions to be considered in applying electric drive and an example of economy from rearrangement of motor drive are taken up.—*Electrical Review*, May 4, 1918.

Wires, Wiring and Conduits

Substitutes in the German Electrical Industry.—An article in *Engineering* gives some interesting particulars of the substitutes being adopted by the German electrical industry, as disclosed in a paper read before a meeting of Swedish Electricity Works representatives by M. T. Husberg. Early in 1914 copper, rubber and other raw materials were commandeered by the German government. The shortage in copper and its alloys has perhaps caused the greatest difficulty. Efforts have been made to substitute zinc for copper, and drawn wire of this material, which is relatively abundant, has been produced by a special squirting process at 500 atmospheric pressures. The brittleness and sensitiveness to change of temperature have, it is said, been much reduced, and it has been employed for busbar conductors of various kinds and even for machine windings. Aluminum and its alloys, although the supply available is limited because of extended use for airplane construction and other munition purposes, are also being employed, especially in the form of alloys, such as "electron" (10 per cent Al, 90 per cent Mg), "magnalium" (90 per cent Al, 10 per cent Mg) and "duralumin" (91 per cent Al, 9 per cent Cu). These alloys are used largely for busbars and castings where non-magnetic material is required. The shortage in rubber, cotton, jute, oil, asbestos and mica has also been pronounced. Paper has been used as a substitute and refined rubber residues substituted for rubber proper, while a substitute for ebonite is found in an artificial product of phenol and formaldehyde. For overhead conductors iron is chiefly used and special regulations are proposed for composite conductors (*e.g.*, galvanized steel with an outer layer of zinc). Overhead lines of zinc alone are not likely to be used. Machines with substitute metals naturally have a relatively low efficiency, the efficiency of direct-current machines with zinc windings and iron commutator being given as 50 per cent, while transformers with zinc windings are credited with 60 per cent. Recently aluminum has been more generally used for machine windings, but even so an efficiency about 20 per cent below that of a machine of similar type with copper windings is experienced.—London *Electrician*, April 12, 1918.

Electrophysics and Magnetism

Sustained Short-Circuit Phenomena and Flux Distribution of Salient Pole Alternators.—N. S. DIAMANT,

—With the ordinary field forms met with in practice, the resultant flux wave under sustained short circuit will be extremely distorted because of the low voltage obtained under such conditions. The fundamental of the *B* curve of the field is reduced so much by the armature reaction that the higher harmonics assume a predominant part and become several hundred per cent of the sustained short-circuit fundamental. The flux distribution at various power factors is considered, and results of investigations to determine the direct component of armature reaction and the resultant flux distribution under sustained short-circuit conditions are given. The author thinks that the words "sudden" and "sustained" seem suitable for specifying the kind of short circuits applied, but the great difference between these two important and complex phenomena of sustained and sudden short circuits should not be lost sight of in any consideration of the subject.—*Proceedings A. I. E. E.*, May, 1918.

Units, Measurements and Instruments

Determination of the Degree of Uniformity of Bars for Magnetic Standards.—RAYMOND L. SANFORD.—Concrete magnetic standards, consisting of straight bars of magnetic material selected and prepared with a view to obtaining the maximum degree of homogeneity, are of very great value in magnetic testing. A method of determining their uniformity is described and curves are given showing the distribution of magnetic induction and leakage for various bars. The observations show the degree of magnetic uniformity that may be expected in ordinary test bars as received. Uniformity curves for a number of characteristic cast-iron bars are given and normal induction curves taken with the permeameter test coils over the different regions of the iron are illustrated.—*Bulletin* of the Bureau of Standards, April 6, 1918.

Study of Electromagnet Moving-Coil Galvanometers for Use in Alternating-Current Measurements.—ERNEST WEIBEL.—This instrument can be used very advantageously with iron in the fixed coil, which results in a marked increase in the strength of the magnetic field, so that the induced current is sufficient to effect satisfactory performance. The equation of motion, effects of reactance, determination of constants and disturbing torques are given in the theoretical section of the paper. In the construction and performance section the general design is discussed and also four separate types of galvanometers. The instrument is better than a vibration galvanometer and equal to the best direct-current moving-coil galvanometer. It also gives satisfactory performance at low frequencies.—*Bulletin* of the Bureau of Standards, April 6, 1918.

Miscellaneous

Heat Transmission of Building Materials.—A. C. WILLARD and L. C. LICHTY.—An investigation to determine the coefficients of heat transmission of standard building materials for exterior walls has been completed at the engineering experiment station of the University of Illinois. The tests were conducted according to the so-called "hot-air-box" method, the boxes being built of the material to be tested and of such size as to insure conditions similar to those found in actual practice. The heating was done electrically so that the input of heat could be controlled and accurately measured. The materials tested included various sizes of plastered tile, magnesia board, cork board, wood, concrete, brick, glass with and without an air space, sheet asbestos and asbestos board. The degree to which the transmission coefficients of the various materials are affected by variations in air velocity, by humidity and by the use of air spaces in the wall is discussed, and the results of the tests are given in detail.—*Bulletin* 102 of the Engineering Experiment Station of the University of Illinois.

Electric Welding in Shipbuilding.—In the discussion on Capt. James Caldwell's paper on "Welding Systems," recently read before the Institution of Engineers and Shipbuilders in Scotland, various speakers especially well informed on the subject referred in definite terms to progress in electric welding as applied to shipbuilding. O. A. Payne, whose remarks had been prepared with the sanction of the Director of Naval Construction, gave the results of experimental work carried out at Portsmouth on plate connections in which there were riveted joints supplemented by runs of welding and plain electrically welded joints. One of the findings was that a plain butt V weld is quite as strong as, or stronger than, the best riveted joint attainable, whether riveted by hand, hydraulic or pneumatic machine, in double or treble rows. The general result of the experiments is that the Admiralty has accepted electric welding in full confidence as a shipyard method having great potentialities. When it is considered that the cost of an electrically welded joint is even now not much in excess of a riveted one, and that the process enables the output per man to be vastly increased—an important factor under existing circumstances—it is seen to be time that electrical welding be placed upon an approved basis in British shipyards, so as to be available at the slipway, dock side or the refitting berths. It can be used first on work of minor importance, such as calking, attaching fittings to water-tight bulkheads, etc., in order to gain experience in handling apparatus. Next it can be used to construct bulkheads flats, etc., with laps partly riveted and partly welded, proportionally reducing the connecting rivets. Finally, when full confidence in the use of the plant had been obtained, electric welding can be substituted to a large extent for the present laborious process of riveting, with great resultant gain.—London *Engineer*, April 12, 1918.

Tests on Oil Switches.—In an appendix to a paper by Dr. C. C. Garrard, read before the British Institution of Electrical Engineers, some interesting tests on the speed of operation of oil switches are reported. A number of tests were made by means of a rotating drum with a pencil mechanically connected to the moving portion of the switch. At the bottom of the drum two traces are made, one by a tuning fork vibrating at a rate of fifty times per second and the other by a marker connected across the trip coil. The latter exactly indicates when the tripping circuit is completed, and the tuning fork gives a time scale. The effect of the oil on the speed is very small, and with the spring in action the contacts separate at the rate of 4.7 ft. (1.43 m.) per second. After this velocity has been reached it remains practically constant during the rest of the movement. Without the oil the initial speed is 3.6 ft. (1.09 m.) per second, and if the spring is not used the speed recorded is not so great as this.—London *Electrician*, April 12, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

PROGRAM FOR N. E. L. A. ATLANTIC CITY CONVENTION

Arrangements Now in Final Shape, and Sessions Will Be Crowded with Vital Papers and Discussions

Arrangements for the war convention of the National Electric Light Association, to be held at the Hotel Traymore, Atlantic City, on June 13 and 14, are in final shape. The program is of direct importance and value to the electric utilities in their effort to use all resources and abilities to give service to the government.

The prospective program in detail follows. One or two other interesting items may be added:

FIRST SESSION

Thursday, June 13, 9.30 *a. m.*

Welcome to the city, Mayor Bacharach.
Presidential address, John W. Lieb.
Report of the treasurer, W. H. Atkins.
Report of the secretary, T. C. Martin.
Report of the membership committee, Walter Neumuller, chairman.
Reports of the national sections.
"Relationships Between the Government and Our Industry," discussion opened by Alex Dow, Detroit.
"War by Civilians," Arthur Wright, London, England.

SECOND SESSION

Thursday, June 13, 2.30 *p. m.*

Report of National Committee on Gas and Electric Service, George W. Elliott, secretary, Washington, D. C.
Report of National Committee on Public Utility Conditions, P. H. Gadsden, chairman, Charleston, S. C.
Report of public policy committee, W. W. Freeman, chairman, Cincinnati, Ohio.
Symposium on labor problems, participated in by Loyall A. Osborne, Washington, National Labor Board; D. H. McDougall, Toronto, president Canadian Electrical Association; Dr. Schuyler S. Wheeler, Ampere, N. J., president Crocker-Wheeler Company; James T. Hutchings, Rochester, N. Y., Rochester Railway & Light Company.

THIRD SESSION

Thursday, June 13, 6.30 *p. m.*

Informal dinner in the main dining room, Hotel Traymore, at which addresses will be made by Oscar T. Crosby, United States Treasury Department; P. B. Noyes, United States Fuel Administration; Samuel Insull, chairman Illinois Council of National Defense; Arthur Williams, federal Food Administrator for New York City; E. W. Rice, Jr., president General Electric Company, and W. W. Freeman, president Union Gas & Electric Company, Cincinnati.

FOURTH SESSION

Friday, June 14, 9.30 *a. m.*

Flag Day exercises.
Appointment of nominating committee.
"The Coal Situation," general discussion led by Past-president Herbert A. Wagner; "The Utilization of Water Powers as a Measure of Coal Conservation," Philip Torchio, New York Edison Company.
Technical Section subjects: (a) "Cable-Carrying Capacity Increase," (b) "Cable Reinstallations," (c) "Aerial Cables," (d) "Female Employment in Laboratories," (e) "Extension of Testing Schedules," (f) "Increased Output from Existing Apparatus," (g) "Increasing Capacity of Overhead Distributing Lines," (h) "Interconnection and Power Requirements of Atlantic Seaboard District."
"Hydro-Turbine Efficiencies," W. W. Nichols, vice-president Allis-Chalmers Manufacturing Company, Milwaukee.

FIFTH SESSION

Friday, June 14, 2.30 *p. m.*

Vehicle Section subject, "The Electric Vehicle as a War Measure," James H. McGraw, New York City, president McGraw-Hill Company.
Commercial Section subjects: (a) "Results of Daylight-Saving Law," Preston S. Millar, New York Electrical Testing Laboratories; (b) "Peak Equalization," R. R. Young, Newark, N. J., Public Service Electric Company of New Jersey; (c) "Stimulating Appliance Sales," John G. Learned, Chicago, Public Service Company of Northern Illinois; (d) "Selling United States War Securities," T. I. Jones, Brooklyn, N. Y., Edison Electric Illuminating Company of Brooklyn.
Accounting Section subjects: (a) "Radical Accounting Practices," William Schmidt, Jr., Baltimore, Md.; (b) "Accounting Education," Fred R. Jenkins, Chicago, Ill.
Report of committee on memorials.
Report of nominating committee.
Election of officers.

SIXTH SESSION

Friday, June 14, 8.30 *p. m.*

"Emergency Construction for the War Department in United States," Col. Peter Junkersfeld.
"Emergency Shipbuilding at Hog Island," Past-president W. H. Blood, Jr.

Frank W. Smith, chairman of the hotel committee, 130 East Fifteenth Street, New York, urges delegates who have not yet secured hotel accommodations to communicate with him at once in order that arrangements for them may be made.

LIGHT LESS IN NEW YORK FOR ENEMY AIR RAIDERS

Experiment Made at Suggestion of the War Department Because of the Submarine Activities of the Hun

New York city experimented with partly darkened streets on the night of June 4 as a precaution against possible bombing by aircraft from a German submarine. Electric signs and other commercial lights, except street and dwelling lighting, were out. The experiment was ordered by the police department at the suggestion of the War Department. United States aviators flew over the city to determine to what extent street lighting alone would guide enemy aircraft. As a result of the observations, these aviators recommended a reduction in street lighting on Fifth Avenue, Broadway and some cross streets. Their recommendations were put into effect and further observations followed.

NEED FOR CONSERVATION OF TECHNICAL ENGINEERS

Engineering Council, in Address to Secretaries of War and the Navy, Voices Alarm at Waste of Technical Training

An address to the Secretary of War and the Secretary of the Navy by the Engineering Council voices the alarm of technical engineers in every branch of the profession who are taking part in the war activities of the army and navy at the unfortunate waste of technical training caused by the drafting and enlisting of engineers for regular service with little or no regard for their technical attainments. These technically educated and experienced men are essential to tne successful conduct of the war and cannot be replaced. There is continuing evidence that America is repeating in some measure England's mistake of sending technical men into the ranks when they should be carefully conserved for special duties in the fighting forces or on the technical staffs.

These facts have been forced upon the attention of engineers who have been co-operating with the government through the Naval Consulting Board, the National Research Council and the Engineering Council. To these organizations requests have constantly been made for engineers, chemists and other technical men for a great variety of military services. Thousands of names have thus been furnished to the government departments and bureaus. The Engineering Council especially has devoted attention to this personal work through its committee, known as the American Engineering Service, which has available classified lists of approximately 25,000 engineers and unclassified lists of many more. It is from these lists, directly or indirectly, that most of the names have been selected for war service.

The total membership represented by the organizations which constitute the Engineering Council or are co-operating with it in this service is approximately 50,000. Already from 10 to 15 per cent of the members of these several organizations are in the uniformed services of the country, and it is safe to say that a large majority of their remaining members are in the government civilian service or otherwise directly or indirectly engaged in the war. Engineers do not seek to avoid fighting, but earnestly desire to be given opportunities for fighting and other services in which they can be most effective and which cannot be performed by others.

It is known that, through the committee on classification of personnel in the war service exchange of the War Department and in some other ways, efforts are being made to counteract the tendency toward the loss of our technical men in the ranks of the army and navy. It is believed, however, that these efforts are insufficient and that they should at once be supplemented by other stringent measures dealing with the subject in the draft boards and recruiting stations.

In view of the foregoing, the Engineering Council, created to provide means for united action and to speak authoritatively for its member societies on all public questions of common interest to engineers, has offered the following resolution:

Whereas technically trained engineers are indispensable to the army, the navy and the war industries, in the Engineering Corps, the Ordnance Bureau and the Signal Corps, in aviation, submarine and tank service, in shipbuilding and in many other assignments; and

Whereas, through draft and otherwise, many of these unreplaceable men have been and are being diverted so that their special qualifications are not being utilized, be it

Resolved, that, in the opinion of the Engineering Council, technically trained men of all ages should be enrolled and conserved for technical duties and special efforts should be made immediately by the War and Navy departments to find and record such men among drafted and enlisted forces and to assign them to places in which their special qualifications are needed, and be it further

Resolved, that the Engineering Council offers to assist the War and Navy departments in locating and classifying such men, if its assistance be desired, provided these departments will give the necessary facilities for collecting information about engineers now in the army and navy or whose names are upon the selective draft lists.

These resolutions are offered solely in a patriotic spirit of helpfulness, writes Alfred D. Flinn, secretary of the Engineering Council, in transmitting the address.

INDIANAPOLIS COMPANIES ASK MORE RELIEF IN RATES

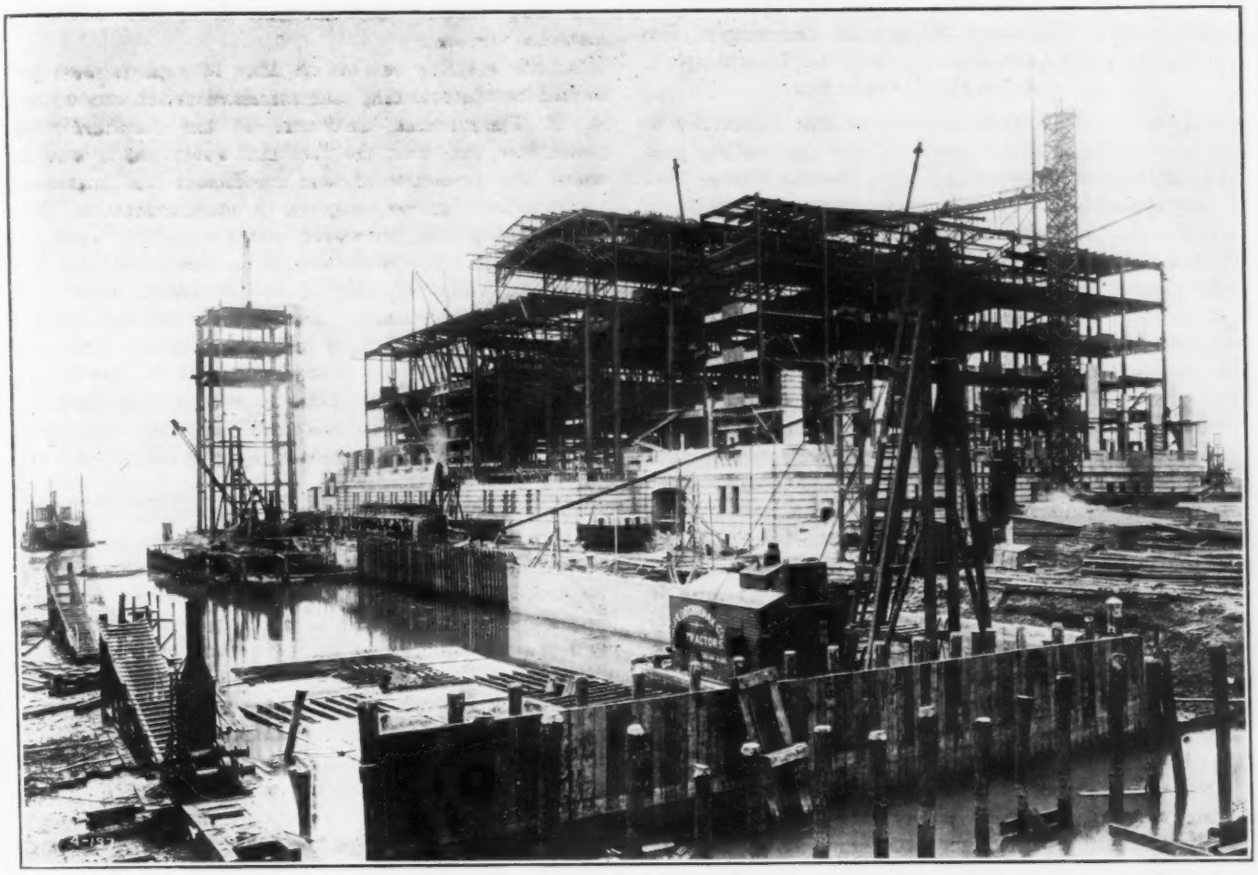
Two Properties Join in Petition to the Indiana Public Service Commission for New Authorization

The Indianapolis Light & Heat Company and the Merchants' Heat & Light Company of Indianapolis have petitioned the Indiana Public Service Commission for authority to add new surcharges to all bills for electrical energy, beginning on July 1. The two companies have been operating since last September under an order from the commission which allowed as a war emergency measure the addition to all bills of 5 mills for each kilowatt-hour of energy consumed. This first relief will expire June 30. The petitions, which the two competing companies filed jointly, have been set for joint hearing on June 17, 18 and 19 by the commission. One of the petitions says:

Petitioner represents and shows that since the filing of its said petition and the entry of the order made thereon there have been additional increases in the cost of coal, labor, material, taxes and other elements entering into the cost of the production and distribution of electric energy, and petitioner is of the opinion, from its experience and from extensive investigations made, that it will not be possible during the continuance of the war to purchase either coal, supplies, materials or labor except at prices greatly in excess of prices prevailing at the time of filing its said petition and the entry of the order made thereon, and that its taxes, both local and federal, have been greatly increased since said time and may be subject to still further increase.

Petitioner says that as a result of the foregoing increase in costs it has suffered serious loss in net revenue and will continue to suffer still greater losses which threaten to and will result in the curtailment of present service and the inability to finance necessary extensions and additions if sufficient temporary relief is not given in such a way as to return to petitioner the difference between the prevailing excessive prices and the normal prices upon which its existing rates and charges are based. That, as a temporary expedient to relieve the financial distress following the extraordinary prices as aforesaid and to make possible necessary betterments and extensions and prevent the curtailment of services, your honorable commission is requested to authorize petitioner to add to each bill rendered by it for all electric service furnished by it a surcharge sufficient to return to it the difference between the present excessive prices and the prices upon which its existing rates and charges are based.

Chester Station of the Philadelphia Electric Company



Philadelphia is in the very center of the country's war activities. The greatest shipbuilding plants, the largest munition works and other war industries are located there. These all use the service of the Philadelphia Electric Company, and W. C. L. Eglin is rushing work on the company's new Chester station to provide 60,000 kw. more this fall.

NEW YORK EDISON RATES TO HOLD NOW

J. W. Lieb Shows Effect of Higher Costs and Reduced Gross Business Upon the Operating Income

At a hearing on June 3 before the New York Public Service Commission, J. W. Lieb, vice-president and general manager New York Edison Company, said that in spite of higher operating costs an increase in rates will not be asked at present.

Mr. Lieb said that the doubts and fears expressed by the company nearly a year ago in relation to a steady increase in the cost of manufacture had been realized. He added:

Our revenue has suffered a considerable decrease due to the reduction in rates, while our output has been actually less than last year. Our expense account has shown a steady increase as compared with last year in the price of coal and labor, and, in fact, in supplies of every description concerned with articles of consumption and those needed in repairs and maintenance.

Our records show that for the four months ended April 30, 1918, as compared with 1917, our operating income has been reduced from $3,624,723 in 1917 to $2,683,069 in 1918, a total of $941,654 in the four months. Net income, therefore, suffered a serious decrease. What the future may have in store for us it is difficult to predict. In fact, with the rapid changes which are taking place we can only express our doubts and anxieties.

The loss in our operating revenue is not entirely accounted for by the reduction in the maximum rate from 7½ cents to 7 cents which went into effect July 1, 1917. It is disquieting, to say the least, that the reduction in the quantity of energy sold was from 223,061,388 kw.-hr. for the first four months of 1917 to 213,513,941 in 1918, a reduction in the output in excess of 4½ per cent.

The increase in operating expenses in 1918 and 1917 is a reflection of the increased cost of coal, of labor, supplies and taxes, and, with the exception of coal, the future price and efficiency of which is at this time problematical, these higher costs will continue, and possibly in an increasing ratio throughout the year. We believe that these conditions would justify the company in going back to the 8-cent rate. At the same time it is not absolutely certain that the decreases in output will continue for the rest of the year.

The present situation is one of extreme doubt and uncertainty. We do not desire to come before the commission at this time and announce our decision to restore the 8-cent rate. We believe that probably the best solution would be a continuation of the present arrangement with the commission, maintaining the status quo for another six months, and reserving such rights as we have under the present arrangement.

The commission agreed to this. The agreement affects practically all points in Manhattan and the Bronx and applies also to the United Electric Light & Power Company.

The company also announced that while it would continue to furnish lamps, it would be compelled to charge for them, and that the prices would be in line with the general increases made by the manufacturers.

WAR SERVICE WORK OF THE ELECTRIC POWER CLUB

Manufacturers of Power Apparatus, Meeting at Hot Springs, Va., Consider Questions Touching Service to the Government

War service and other matters related intimately to war conditions occupied much of the interesting program at the annual meeting of the Electric Power Club at the Homestead, Hot Springs, Va., on May 30 to June 1. The attitude of the manufacturers of power apparatus and of the government was the subject of discussion at special sessions to which all such manufacturers were invited, whether they were or were not members of the club.

As a representative of the government, Walter Robbins, chief of the power equipment section of the finished products division of the War Industries Board, showed the tremendous and fast-increasing scope of the nation's war mobilization. Robert K. Sheppard, chairman of the General War Service Committee of the Electrical Manufacturing Industry, outlined the spirit in which its work is being done and the patriotic need of the devotion of every resource to the one aim of winning the war. In addition, the address and remarks of C. L. Collens II, the president, and of others made plain the desire to give the fullest measure of support in the paramount cause.

President Collens on Standardization

At the opening meeting President Collens called attention to the permanent importance of the work of standardization, with which little was done last year because members gave their time to the war program. He said that standardization, however, had been the main work in the past and that it must still be a very important part. The handbook of standards is still far from complete and omissions should be supplied as the work can be done.

In his address at the meeting last fall Mr. Collens recommended that if possible the work of the club be broadened to endeavor to correct any bad practices in the industry, promote equitable competitive relations, and place the industry on a sound economic basis. He still feels that this ought to be undertaken, especially if it is done in full co-operation with a government agency. The club activities should be broadened so as to include commercial standards as well as the character of work done in the past.

President Collens then reviewed orders, rulings, etc., of the Federal Trade Commission affecting other industries, but which he felt were instructive as indicating the trend in the gradual development of properly defining what unfair competition is and the classes of bad practice which should be eliminated. Among these were the question of quality, so that there should be no room for misunderstanding by the public; contracts giving rebates based on volume of business, especially if contingent on the customer's refusal to deal with others; giving something to influence purchases; discrimination as to price, as in making prices very low or below cost in competitive territory.

Another point is the Federal Trade Commission's desire to compile statistics by industries. Mr. Collens believes with the commission that this is a function of the government and that the manufacturers should aid.

The possibilities of foreign trade under the Webb law should also be considered, added President Collens.

It was voted to remit the dues of all members in the national service.

At the evening session on May 30 reports were presented by the standing and standardization committees. A. H. Timmerman, chairman of the standardization committee, said that the fact that every one is working under the pressure of war conditions has materially handicapped further progress in standardization. Notwithstanding this, however, some excellent work has been done and the work should be continued.

Upon recommendation of the standardization committee it was decided to appoint as a sub-committee a safety committee to draw up safety rules. This committee will be entirely distinct from both the Underwriters' Laboratories and the Bureau of Standards.

Changes to classify the rules on dielectric tests, recommended by the committee on fractional-horsepower motors, were approved.

The general engineering recommendations committee presented the report of the conference committee of the American Institute of Electrical Engineers and the National Electric Light Association, making additions to the method of terminal marking on transformers, This was adopted, to go into effect not later than June 1, 1919.

Some discussion took place over the question of packing for foreign shipment, which has been taken up by the government from the point of view of saving ship space. It was also brought out, in connection with a reference to the bulletin issued recently by the General War Service Committee of the Electrical Manufacturing Industry, that the companies are making strenuous efforts to reduce tin consumption.

Working with the War Industries Board

At the first "war service session" on May 31 Walter Robbins, before taking up in detail the work with which he is in direct touch because of his position in the War Industries Board, gave a comprehensive picture of the great organization which has been developed to handle new governmental activities incident to the war, showing how bureaus had been expanded and new agencies created to deal with the large problems.

Mr. Robbins illustrated by one chart the general classification of purposes demanding preference treatment and by another the interrelations of the various divisions and committees of the War Industries Board.

The War Industries Board uses the committee form of operation, or conference system, which has been found to give the best co-ordination and results.

In showing the way in which the government necessities become greater and greater Mr. Robbins spoke of the pledge which the steel manufacturers have given, as follows:

> For myself, my corporation or my firm, I pledge the prompt production and delivery of the largest possible quantity of material in our departments that is or shall be required by the United States government for the necessities of itself and its allies, and agree that all other lines of our business shall be subordinated to this pledge, and all this in accordance with the request of the War Industries Board.

In answer to a question, Mr. Robbins said that the zone system which is now under consideration was designed to facilitate the distribution of new needs to in-

dustries now operating on the less essential types and to facilitate the distribution of materials without useless transportation from district to district.

In general, the advice of Mr. Robbins is that each manufacturer begin now to satisfy himself that the work which he is doing is essential to the war. Every manufacturer should have his business so classified that he would know that which is essential or "non-essential" or in a middle class.

Robert K. Sheppard then told of the activities of the General War Service Committee of the Electrical Manufacturing Industry. He mentioned specific instances in which service has been given to the government and outlined the general attitude and purposes of the committee.

Speaking as chairman of the war service committee of the Electric Power Club, President Collens said that the power apparatus manufacturers co-operated with the War Industries Board some time ago in making a canvass which indicated that there were 15,000 motors

C. L. COLLENS, II

in stock in the country, and the disclosure of this fact eliminated the apparent shortage which existed at that time. The war service committee of the Electric Power Club has also assisted the General War Service Committee in organizing the power apparatus manufacturing branch of the industry into groups. Since the original organization of these groups four others have been added, electro-medical apparatus, radio apparatus, electric furnaces and electric welding. Organization of a group for electric storage battery manufacturers is now in a preliminary stage.

It is hoped to extend this, said Mr. Collens, so that in the end the electrical manufacturing industry will be organized 100 per cent. The effort will be to develop the efficiency of the group committees so that the general committee will be largely executive.

It was announced by Mr. Collens at the evening session on May 31 that the board of governors, after considering the reports on war service, had some preliminary recommendations to offer until more definite advice can be given. Each manufacturer should endeavor to determine as business is received into what class it falls regarding the war. Three classes of business are recognized as essential—direct government orders, indirect government orders, and work of exceptional or national importance which, while not directly touching the war, is of great public interest and essential to public welfare.

It would be desirable to get a definite idea of the purposes for which apparatus not of these three classes is intended. If the order as received is not covered by a priority certificate, a written statement should be secured from the customer showing to what purpose it is to be put.

It is also recommended by the committee, added Mr. Collens, that manufacturers prepare immediately to tabulate data regarding needed raw materials, such as sheet steel, castings, bar steel, tool and alloy steels, copper wire, adhesive tapes, mica, fabrics, babbitt, solder and varnishes. Information should be prepared showing consumption last year and rate of monthly consumption now. As the nature of the business requires that power apparatus be manufactured for stock, there will have to be some agreement or guarantee that products will be reserved for essential war work.

It is desirable, Mr. Collens said, that each manufacturer study his own situation and if possible increase the percentage of his war work. Foreign orders should not be taken unless the necessary export license is secured.

F. S. Hunting and J. C. Hobart discussed the question of labor shortage and the employment of women.

S. L. Nicholson described experiences in transportation and embargo matters. A representative of the War Industries Board, T. C. Powell, is authorized to act to grant relief to manufacturers in these matters.

REPORT ON TRADE ACCEPTANCES

Mr. Hobart presented a report as chairman of the committee on trade acceptances, recommending the use of this system and showing the national economic advantages which make it especially desirable under war conditions. The report was adopted.

The first business at the concluding session on June 1 was the presentation of a report on handling freight claims, prepared in the secretary's office.

James Burke presented a paper on "Economies in Building Motors During the War." He urged full exchange of information and experience between manufacturers and every other form of effort to assure the largest possible economies of material and labor while the war lasts.

Dana Pierce, Underwriters' Laboratories, Inc., spoke on standards for control apparatus with reference to accident hazards. He asked the co-operation of the club in the preparation of standards which the Laboratories have been requested to compile for the National Workmen's Compensation Service Bureau. The matter was referred to the board of governors, which will act on it.

Dr. M. S. Lloyd, Bureau of Standards, spoke on the importance of the safety work.

H. F. Stratton, chairman of the cost accounting committee, reported that the club, as at present organized, does not include representatives who are specially concerned with cost accounting. The committee feels that the industry would be benefited by stabilization of cost accounting and recommends enlargement of the functions of the club.

O. F. Stroman delivered an address on "Variations in Manufacturing and Commercial Cost," with diagrams. He showed a method of determining the ef-

fect on manufacturing costs of market changes in basic costs.

J. C. Hobart, member of the war service committee, reported on fuel supply and conservation. He indicated the shortage in production below consumption demands and urged that every one inspect his methods of burning fuel.

F. M. Kimball, W. A. Layman, J. C. Hobart and S. L. Nicholson were elected directors. At the ensuing meeting of the board of governors officers were elected for the new year as follows:

President, Clarence L. Collens II, Cleveland; vice-president, James Burke, Erie, Pa.; secretary, C. H. Roth, Chicago; treasurer, R. J. Russell, St. Louis.

JOBBERS TO CO-OPERATE WITH THE CONTRACTORS

Resolution Passed by the Electrical Supply Jobbers' Association as a Result of Conference of Committees

At the request of the National Association of Electrical Contractors and Dealers the co-operation and harmony committee of the Electrical Supply Jobbers' Association met a committee of three contractors, appointed by the contractors' association at the Homestead, Hot Springs, Va., on May 19, 1918. The following were present, representing the contractors' association: W. K. Tuohey, Springfield, Mass., chairman; J. R. Strong, New York; G. M. Sanborn, Indianapolis. Representing the jobbers there were W. E. Robertson, chairman; F. S. Price, N. G. Harvey, F. M. Bernardin, E. W. Rockafellow, Fred Bissell, V. C. B. Wetmore (by invitation), F. Overbagh, F. E. Neagle and E. D. Tolles.

After a full discussion of the problems confronting the electrical contractors, a request was made by them summarized as follows:

That the jobbers aid the contractors' association to increase its membership by, personally and through salesmen, urging contractors not members to join the association.

That in the same way the jobbers urge retail electrical dealers, hardware and other stores operating retail electrical departments to become associate members, and that jobbers operating retail departments also join the association, to the end that a far-reaching, properly financed campaign of education as to cost accounting and proper merchandising methods may be carried on, resulting in making the contractors better business men and merchants and larger and better customers of the jobbers, with a corresponding improvement in the credit risk involved.

That the jobbers' association appoint a committee to attend the national meeting of the contractors' association at Cleveland in July and that this committee, preferably of three, meet a similar committee of contractors to confer from time to time with reference to matters of mutual interest.

As a result of the meeting of the committees, the following resolution was passed by the Electrical Supply Jobbers' Association:

Your committee, in accordance with the objects expressed in the constitution of this association, believes that we should forward, by co-operative action, improvement in all lines that will benefit the electrical industry and therefore recommends:

First—That all members of the jobbers' association having retail departments become associate members of the contractors' association.

Second—That the members of the association personally and through their salesmen urge all electrical contractors and electrical contractor-dealers to become members of the contractors' association, and urge all electrical dealers and all other merchants operating retail electrical departments to become associate members.

As there seems to be some misunderstanding as to the meaning of the term "retail department" or "retail business," the following definition, to avoid misunderstanding on the part of jobbers not present, is given:

By retail departments operated by jobbers your committee understands the term to cover departments that sell at retail prices, in retail quantities, to the consumer, and expressly excludes sales to isolated plants, central stations and power companies, philanthropic, educational, health or corrective institutions or enterprises related thereto; industrial firms or corporations of every kind engaged in commerce or in undertakings relating thereto; the government or any political subdivision thereof or agency in connection therewith.

Third—That the invitation to attend the national convention in July be accepted, and that the chairman of the co-operation and harmony committee designate three members of the committee to attend.

THE KANSAS CITY CENTRAL STATION RATE SITUATION

Analysis of Conditions That Make an Increase in Charges Necessary and a Statement of What the Company Is Asking For

In May, 1917, the Missouri Public Service Commission reduced the rates of the Kansas City (Mo.) Light & Power Company. At that time the commission decided to allow the Kansas City company to earn 6½ per cent on a valuation of $7,200,000. A rate schedule was made effective which it was expected would give the company the stipulated return.

Prevalence of high prices and constant increase in cost of labor and material during the year have prevented the company from getting the net return expected. The earnings have fallen $300,000 short of the allowable amount. During the same time a reduction in steam-heating rates was made effective. This has added further burdens to the company, and if these heating rates are effective during the coming winter the company's heating revenue will be reduced $100,000. But, in addition to all this, the rate which the Kansas City Light & Power Company pays the Kansas City Railways for electricity which it buys to distribute has been increased by the commission by an amount that means an added annual expenditure of $400,000 to the electric light company. The rate was formerly 1 cent per kilowatt-hour. It was increased to $15 per kilowatt of maximum demand and 1.14 cents per kilowatt-hour.

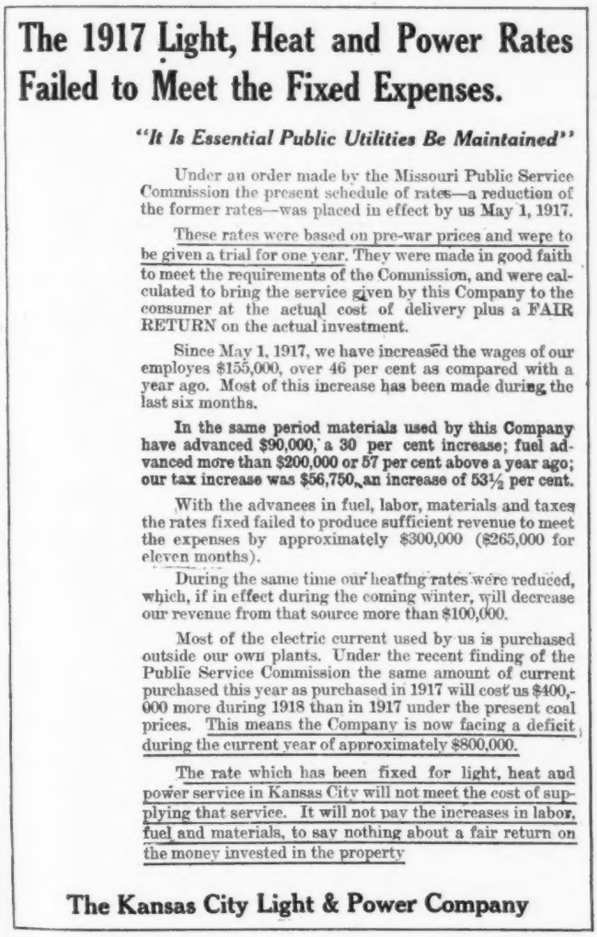
So in the aggregate the company stands to-day with $300,000 less than the commission expressed willingness to allow it and also in a situation where it will see revenues reduced and expenses increased. The shortage for the coming year, unless some relief is granted, will be in round figures $800,000, in addition to the existing shortage of $300,000.

The company has asked the commission for this relief in the shape of an increase in electric service rates.

The approximate amount of the increase asked is $500,000. The application to secure this increase in revenue contains two plans either of which the company considers satisfactory.

One plan contemplates an increase in all rate schedules in an amount equal to about 1 cent per kilowatt-hour. This applies to both power and light. At present the top step in the residential rate is 8 cents.

The other plan is a combination of the surcharge and straight increase ideas. Under the terms of this plan the company asks a surcharge of 7 cents per room per month against residential consumers; a surcharge of



The 1917 Light, Heat and Power Rates Failed to Meet the Fixed Expenses.

"It Is Essential Public Utilities Be Maintained"

Under an order made by the Missouri Public Service Commission the present schedule of rates—a reduction of the former rates—was placed in effect by us May 1, 1917.

These rates were based on pre-war prices and were to be given a trial for one year. They were made in good faith to meet the requirements of the Commission, and were calculated to bring the service given by this Company to the consumer at the actual cost of delivery plus a FAIR RETURN on the actual investment.

Since May 1, 1917, we have increased the wages of our employes $155,000, over 46 per cent as compared with a year ago. Most of this increase has been made during the last six months.

In the same period materials used by this Company have advanced $90,000, a 30 per cent increase; fuel advanced more than $200,000 or 57 per cent above a year ago; our tax increase was $56,750, an increase of 53½ per cent.

With the advances in fuel, labor, materials and taxes the rates fixed failed to produce sufficient revenue to meet the expenses by approximately $300,000 ($265,000 for eleven months).

During the same time our heating rates were reduced, which, if in effect during the coming winter, will decrease our revenue from that source more than $100,000.

Most of the electric current used by us is purchased outside our own plants. Under the recent finding of the Public Service Commission the same amount of current purchased this year as purchased in 1917 will cost us $400,000 more during 1918 than in 1917 under the present coal prices. This means the Company is now facing a deficit during the current year of approximately $800,000.

The rate which has been fixed for light, heat and power service in Kansas City will not meet the cost of supplying that service. It will not pay the increases in labor, fuel and materials, to say nothing about a fair return on the money invested in the property

The Kansas City Light & Power Company

HOW THE KANSAS CITY COMPANY TALKED TO THE PEOPLE

$1 per kilowatt of connected load per month on commercial consumers, and an increase of 25 cents per month per kilowatt of demand on an increaes of ½ cent in the energy rate for power customers.

No change in the municipal lighting rate is asked.

In preparation for the pending hearing on its application for increased rates the company has conducted an advertising campaign in the daily papers. This advertising is written in a vein of frankness and sincerity. It sets forth that the company is supplying power to many essential war industries and that it is therefore essential and must be maintained. President Wilson's correspondence with Secretary McAdoo is quoted. Facts and figures from the company's books are also used to show that the company has not made the money which the commission said it is entitled to make.

IOWA ASSOCIATION DISCUSSES PROBLEMS OF VARIOUS SORTS

Methods of Holding Labor, Securing Higher Rates and Saving Coal Are Topics of Two-Day Round-Table Discussion

On May 31 and June 1 the Iowa Section of the National Electric Light Association held at Des Moines its first convention since the declaration of war. About fifty operating men, most of whom are responsible heads of properties, were in attendance. The convention was noticeably different from those in former years because of its entire lack of entertainment features and the absence of set papers. The program, as laid out, provided only for discussions of topics which are now uppermost in the minds of all utility men. The convention was also notable for the wealth of valuable discussion which its more or less informal sessions developed.

President John M. Drabelle, in addressing the first session, dwelt at length on the increasing cost of giving service and the difficulty of keeping sufficient labor. He expressed the belief that interconnection of plants and the shutting down of inefficient stations could be carried still further with beneficial results. As a suggestion to companies which are having trouble in getting local city councils to agree to proper rate increases, he advised that recourse be had to the federal courts. He also stated that, in figuring rates, companies should revise their ideas of interest and fixed charges.

A round-table experience meeting on the labor situation brought out that difficulties in getting and keeping plant men are extraordinary. It was the opinion that it is cheaper to pay more, to firemen especially, than to change frequently. In Iowa wages for firemen and engineers are now ranging between $80 and $100 a month for shifts from eight hours to twelve hours long. On the question of hiring women it was agreed that it is wise to begin immediately, if the plan has not already been adopted, to replace with women men who leave, so that it will be posible to get into the woman labor market while conditions are favorable. While only one man present had had experience with women as meter readers, many seemed to think they would soon be using women in this work.

F. A. Warfield of Peoria, Ill., leading the discussion on rates, told how the properties of the Illinois Traction System had recently secured an increase amounting to 18 per cent. He also emphasized the national aspect of the present tendency to ask for increased rates and pointed out that it is as much to the interest of communities as to utilities that relief be granted to afflicted companies. He declared the present rate situation to be a test of commission regulation. The discussion brought out that many rate increases have been effected in Iowa. These have amounted to an average of about 20 per cent, but some rates will have to be raised a second time. Even in communities paying 16 cents for energy the price has been raised to 20 cents per kilowatt-hour.

Next in point of interest to the question of getting more revenue was that of reducing operating expense. This program, it was conceded, should start in the boiler room. E. S. Hight of Peoria, in leading the discussion, stated that a boiler-room economy department of the Illinois Traction System had saved the company

$239,000 in six years by simply seeing that the obvious sources of loss were stopped.

Frank Linebaugh of Boone, Iowa, speaking on the coal situation, urged early purchase and storage. "No all-wise authority," he said, "is going to take care of central stations this winter. They must help themselves by storing clean lump coal if the other grades they can secure do not permit successful storage." Mr. Linebaugh also advised that managers study the relative cost of operating on mine-run coal and steam coal. In many instances it will be learned that the higher-priced coals are least expensive in the long run. While coals which contain lumps require crushing, Mr. Linebaugh said plants should have crushers anyhow for emergency work.

Those who took prominent part in the various round-table discussions were: W. H. Abbott, Omaha, Neb.; R. H. Holbrook, Cedar Rapids; H. Simonds, Dubuque; M. G. Linn, Des Moines; R. C. Clifton, Idagrove; E. T. Hughes, Sheldon; John M. Drabelle, Cedar Rapids; Harold Boehner, Malvern; J. W. Walsh, Burlington; R. E. Brooks, Red Oak; C. E. Fahrney, Ottumwa; C. O. Ingersoll, Marion; L. C. Spake, Chicago, and Mr. Hamlon, Mason City.

Officers elected for the ensuing year are: President, Herbert Bellamy, secretary Marion County Electric Company, Knoxville, Iowa; vice-president, O. H. Simonds, Dubuque; secretary-treasurer, M. G. Linn, Des Moines; assistant secretary-treasurer, Ira Steel, Des Moines, and director, John M. Drabelle, Cedar Rapids.

EXEMPTION PROVIDED FOR TECHNICALLY TRAINED MEN

Highly Skilled Enlisted Men Are to Be Returned to Necessary Industries by the War Department

In response to appeals from all over the country, the War Department has decided upon a policy which will permit the return to necessary industries of highly skilled men taken from such industries, under a system of furlough which will be automatic and which will not in the future as in the past leave to the discretion of company and other subordinate commanders the question of whether such furloughs shall be granted. Thousands of applications for such furloughs are now being sent out of Washington by various branches of the War Department, in response to the appeals of manufacturers and other producers of war material whose draftsmen, mechanics and other employees, engaged in the past and now upon government orders for war work, have been taken from them by operation of the draft.

The application blank is reproduced here.

The adoption of the new policy means that enlisted men are to be returned to industry only in cases where the drafted man's employer is willing to swear that the man is badly needed and that no one can take his place. The government department for which the manufacturer or other employer is working will, upon application, send one of the blank forms to the employer, which he must fill out, swear to before a notary and have a government inspector conversant with the facts also sign. The signed application then goes to the Adjutant General's office, with request from the interested government department that the man wanted be granted an indefinite furlough, without pay, with the promise that after the need for the man's service has passed he will be returned to the army and the government notified.

While such men are on furlough they are not to be allowed to wear the uniform. The company employing such men must furnish to the government each month a report that such men are still in employment and of the class of work in which they are engaged. In case such men leave their employment the employers must immediately notify the government.

APPLICATION FOR RETURN OF ENLISTED MAN IN HIGHLY SKILLED CLASS OF LABOR TO "NECESSARY" INDUSTRY

Dated at.....191

Application is hereby made for the return of following enlisted man:

Name....., Residence.....

Exact description of trade.....

Registered Local Board..... Order No..... Serial No....

Last reported to Camp..... Unit.....

Taken into army.....191 , because.....

.....

.....

We ask that he be directed to report to.....

.....

We have the following direct government contracts:

Date	Gov. Order No.	Quantity	Description	Dept. of Gov.
....	.....	.....	.....	.....
....	.....	.....	.....	.....
....	.....	.....	.....	.....

We are under contract with the following, who have direct government contracts from.....Dept.

.....

.....

We have established our status as "necessary" industry with District Board No..... of State..... located at.....

.....

By.....(title)

Sworn to before me at.....

this..... day of.....191..

.....

.....

Title of official administering oath

I have checked the foregoing statements and have found them to be correct.

.....

.....

Local representative of.....dept.

Thousands of applications for furloughs for enlisted men in necessary industries have recently reached Washington, and Washington has been unable to grant permission for the necessary furloughs because company commanders and other subordinate officers could not be convinced that certain of their men might be more necessary in civil life than in the ranks. The Adjutant General's office has now sent a circular to heads of War Department divisions permitting the new system. The government is protected, from the army-in-the-ranks point of view, by the fact that wherever a fraud is perpetrated or an attempt is made to perpetrate fraud enough persons will be familiar with the facts to result in the War Department being notified.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Electrical League of Cleveland.—William T. Clark, a Civil War and Spanish War veteran, talked before the Electrical League of Cleveland on Wednesday, May 29.

N. E. L. A., Toledo Section.—At a meeting of the members of the joint section of the Toledo Railways & Light Company and Associates held May 24 G. E. Snider was elected chairman and G. E. Lafferty secretary.

A. I. E. E., Erie Section.—The Erie (Pa.) Section of the American Institute of Electrical Engineers held a meeting on May 23, at which the subject of discussion was "The Part Electricity Is Taking in the World War."

New York Electrical Society.—The annual meeting of the New York Electrical Society for the election of officers was held in the board room of the National Electric Light Association, in the Engineering Societies Building, New York, on June 6.

San Francisco Electrical Development League.—At the May 29 meeting of the San Francisco Electrical Development League D. C. Nutting, superintendent construction of the navy at the Union Iron Works, San Francisco, spoke on "How Shipbuilders Are Helping to Win the War."

A. I. E. E., Spokane Section.—The annual session of the Spokane (Wash.) Section of the American Institute of Electrical Engineers was held on May 17. Prof. M. K. Akers spoke on "The Fundamental Mathematics of Alternating-Current Circuits," and P. T. Acland of the Forty-eighth Highlanders of Canada gave his "Recollections of Ypres Salient."

Electrical Dealers and Contractors of Tennessee, Mississippi and Arkansas.—On May 27 and 28 the Electrical Dealers and Contractors of Tennessee, Mississippi and Arkansas held a meeting in Memphis. W. L. Goodwin gave a talk on "The Science of Electrical Merchandise." General trade topics were discussed at the meeting, and the aviation camp at Millington, which is near Memphis, was visited by the members attending the meeting.

A. I. E. E., Portland Section.—The last meeting of the Portland Section of the American Institute of Electrical Engineers was held on June 4 at Crown Point on the Columbia Highway. O. F. Stafford, head of the department of chemistry at the University of Oregon, addressed the meeting on "Utilization of Waste Wood in Two New Processes." The apparatus described was developed at the University of Oregon for producing distillation products and high B.t.u. gas.

Society of Automotive Engineers.—There will be a meeting of the Society of Automotive Engineers at Dayton, Ohio, on June 17 and 18. The papers will be on subjects such as refining of petroleum, aeronautic engineering, tractor engineering and the design of heavy fuel engines.

National District Heating Association.—Although there will be no regular convention of the National District Heating Association this year, it has been decided that the executive committee, together with the chairmen of the standing committees and as many members as possible, will hold a meeting at the Breakers Hotel, Cedar Point, Ohio, July 8 and 9, to discuss various matters now affecting the heating companies and to receive the reports of the standing committees for the year.

National Association of Manufacturers.—Among the important papers presented before the twenty-third annual meeting of the National Association of Manufacturers at New York were "Export Trade During War Time," by H. B. van Sinderen, director Bureau of Exports, Washington, D. C.; "France and Her Industrial Needs," by Charles F. Beach of Paris; "Combinations for Foreign Trade," by N. B. Williams, Washington, D. C, and "Trade Acceptances and the Manufacturer," by W. M. Nones, Norma Company, New York.

A. I. E. E., San Francisco Section.—At the May 24 meeting of the San Francisco Section of the American Institute of Electrical Engineers Lieut. William S. Leffler, reserve military aviator, described the training given to combat flyers. Before entering the air service Lieut. Leffler was assistant to W. W. Briggs of the Great Western Power Company. Lieutenant Flynn of the British Royal Flying Corps, an instructor at the Fort Worth (Tex.) flying school, also spoke on the work of the air service. J. W. Beckman of the Beckman-Linden Company, read a paper on "Electrochemistry and the Power Industry."

Providence Engineering Society.—The importance of thermal insulation as a factor in coal saving in steam plants under present conditions was emphasized at a recent meeting of the Providence (R. I.) Engineering Society in a paper by L. B. McMillan, consulting engineer, general power specialties department, H. W. Johns-Manville Company, New York. At present fuel costs, the author said, the losses of heat encountered in uninsulated pipe and fittings are very serious. The loss of heat per square foot of bare pipe at 100 lb. pressure may easily represent the equivalent of more than one-third of a ton of coal per year at the pipe surface alone, or more than one-half ton at 150 lb. The loss at the coal pile itself may be five or ten times as great. More attention should be given to insulating pipe flanges than in the past. A 10-in. bare flange at ordinary steam-plant pressures like the above may cost more than a ton of coal per year in fuel loss. From 80 to 90 per cent of these losses can be prevented.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Wires Accessible to Boys.—Electric companies stretching wires through trees which children can climb must anticipate their presence in such trees, and where a boy climbed from a building into a tree and a twig broke and he fell against electric company's uninsulated wires and was injured, the company was liable, the Supreme Court of Missouri held in Williams versus Springfield Gas & Electric Company (202 S. W. 1). Where a boy playing upon a building belonging to another party by owner's sufferance climbed upon a tree either on such party's premises or in an alley and while there was injured by defendant's uninsulated wires, such boy was not a trespasser as to defendant. Where plaintiff, a boy, climbed into a tree and slipped or fell, because of the breaking of a twig, against defendant's uninsulated wires passing through the tree, and there was no evidence that he knew of the defect of the insulation or that he purposely touched the wires, contributory negligence is not shown.

Validity of Municipal Contract with Competing Utility.—The act of the Georgia General Assembly empowering the board of lights and waterworks for the city of Marietta to "take the proceeds of any bonds sold for the purpose of creating a system of waterworks and build and erect such waterworks for the best advantage of the city," and to this end, if thought proper, to "purchase and acquire any property now owned and operated by any other company," and to "make all contracts for the lights and water supply for the city of Marietta," did not authorize such board, after it had built and equipped an electric light and waterworks plant, to pay $15,000 to a competing plant to "quit operating its electric light plant in the city," where, under the contract, the board obtained nothing in the way of plant, poles, wire or other property of any kind from the selling company, and where the consideration was not money arising from authorized sale of bonds, but where part of the purchase price was to be met by unauthorized borrowed money and a new debt created for the remainder, payable in notes due beyond the year in which they were executed. In the opinion of the Supreme Court of Georgia (95 S. E. 7) such contract is illegal and the payment of such notes can be enjoined at the instance of a taxpayer of the municipality. This ruling above makes it unnecessary to decide whether the contract would have been legal had the consideration therefor been obtained from the sale of the bonds authorized by the act.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

San Diego Company Now Employing Water Power.—On May 21 connection was made with the Southern California Edison Company's transmission lines at San Juan Capistrano, and the San Diego Consolidated Gas & Electric Company is now purchasing a considerable part of its electric energy requirements from the Southern California Edison Company, whose electricity is largely developed by water power.

War-Time Strikes on War Utilities.—Commenting on the threatened strike of the Western Union telegraphers, the New York Times says in an editorial: "Public utility strikes differ from other strikes in that the rights of the public are superior to those of either party to the strike. Capital is not compelled to invest in public utility undertakings, but if it does invest it invests with knowledge that the investment is subject to continuous service of the public. There should be the same understanding on the part of labor. . . . There should be no reluctance to meet the issue. It will not grow less if dallied with. The right to unionize, the right to bargain collectively, the right to improve conditions of employment, are all subordinate to the right of the public to have uninterrupted public service. If there should be a strike so obviously in the interest of the enemy, there should be the strictest inquiry into any concealed motive for the strike, and punishment fit for any such disclosure of treachery."

Change of Rates Sanctioned in San Bernardino, Cal.—The California Railroad Commission has authorized the Southern Sierras Power Company and the Southern California Edison Company to change their electric lighting rates for domestic and commercial service to consumers in San Bernardino. This revision of the previous rates fixed by the commission will reduce the rates to residence and large commercial lighting consumers, while the rest of the rates will remain as formerly fixed. The company asked for the change. The new rates are as follows for both companies: First 100 kw.-hr. a month, 7 cents per kilowatt-hour; next 200 kw.-hr. a month, 6½ cents per kilowatt-hour; next 200 kw.-hr. a month, 6 cents per kilowatt-hour; next 500 kw.-hr. a month, 5½ cents per kilowatt-hour; next 1000 kw.-hr. a month, 5 cents per kilowatt-hour; next 1000 kw.-hr. a month, 4 cents per kilowatt-hour; next 2000 kw.-hr. a month, 3 cents per kilowatt-hour. All energy used in excess of 5000 kw.-hr. a month is to be blled at 2½ cents per kilowatt-hour; minimum monthly bill, 75 cents.

The Doherty Fraternity Plan.—The initial plan for a Doherty fraternity, to be known as "The Doherty Men," has been prepared by a committee of which George Williams of New York is chairman. It is proposed that there be a central organization which shall grant charters to subsidiary bodies on their petition. The general purposes of the fraternity, it is stated, are to foster patriotism, to promote the interests of Doherty men and their families, and to perpetuate and develop the business ideals of Henry L. Doherty. Different classes of membership are contemplated.

Hartland Power Company.—The Hartland Power Company was organized several months ago as an independent public utility operation by W. S. Barstow & Company, New York, and Steel, Jones & Company, bankers, Philadelphia, to supply power to West Virginia coal mines. The plant of the company is at Hartland, on the Elk River, West Virginia, the center of the new coal-mining activities, and consists of 1000-kw. General Electric steam turbines, complete with condensers, boilers, etc. Construction work is now completed, the organizers state, and within the next ten days the company will start operation. Transmission lines have been built up Middle Creek to the coal mines in the section and are being extended to other nearby developments. The coal operators are rapidly installing modern electrical machinery and a number of them are ready for power. Within a radius of four miles of the power plant there are some ten or twelve large coal-mining developments. The Coal & Coke Railroad, running along the Elk River Valley, passes through the center of the field and is equipped with adequate facilities for handling a large output.

Officers for Submarine Duty Needed.—Lieut. Commander Conant Taylor, U. S. N., calls attention to the fact that the submarine force of the United States Navy requires the services as officers on board submarines of young men who have had technical training and experience in mechanical and electrical engineering. It is intended to enroll a number of such men as provisional ensigns in the Naval Reserve force, give them a course of instruction in deck duties at Annapolis and a course in submarine work at New London. Those who successfully pass these courses will then be sent on board submarines for regular duty. Candidates with the degree of M. E., E. E. or E. M., who have had two and a half years' practical experience in their profession and are not over thirty-five years old and physically strong and sound, should apply to the commander of the submarine force, U. S. S. Chicago, care of Postmaster, New York. The indorsement of one of the following organizations is desirable but not obligatory: Naval Consulting Board, National Research Council, American Society of Mechanical Engineers, American Institute of Electrical Engineers and American Institute of Mining Engineers.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates of Return in Illinois.—The Illinois Public Utilities Commission, in a decision affecting the Citizens' Gas, Electric & Heating Company, Mount Vernon, allowed a return of 6½ per cent for gas property which appeared undeveloped, 8 per cent for electric property which seemed efficiently managed, 7 per cent for water property and 6 per cent for heating property which appeared ill-advisedly located. The commission believed, in considering the reproduction cost of utility property, that it would be just and proper that the value of utility land should reflect proportionate increases of value as shown to exist in adjacent and comparable property.

Rate-Making Practices in Illinois.—Authorizing an increase in electric rates by the Lena Electric Light & Power Company, the Illinois Public Utilities Commission comments on rate-making practices as follows: "It appears from the record that the company in the past has charged certain consumers at flat rates for power service. These consumers in some cases have been large users of power. In addition to these power consumers several lighting consumers have been charged at flat rates. This practice must be discontinued in the future and all rates must conform to the schedules on file. The commission has frequently expressed itself regarding flat rates when applied to consumers who have the opportunity to waste energy. In the case of very small light consumers whose monthly bills would scarcely justify the installation of a meter there appears to be a legitimate demand for flat-rate service. For a small plant, and particularly in case it does not operate twenty-four hours per day, it would appear that the advantages of such a rate more than offset its theoretical disadvantages. Such a rate will be provided in the schedule hereinafter ordered. The records of the company have not been well maintained. No records are available showing the energy supplied for municipal pumping or for some of the largest power consumers; neither are there means provided for obtaining the total energy generated. The order will provide for maintaining more complete records. The rates filed by the company contemplate a monthly minimum bill for lighting service of $1.25 per month per consumer. This amount is unusual for a community of this size, and in the absence of proof as to any peculiarity of conditions which would make the cost of service to small consumers unusually expensive the commission will not authorize an increase in the present minimum bill, which is $1 per month."

Men of the Industry

Changes in Personnel and Position—
Biographical Notes

H. N. Slaughter, lieutenant-colonel in the Signal Corps, engaged in the development of radio apparatus for all branches of the army, was research engineer for the Western Electric Company on radio-telephone work for a year and a half prior to entering the Signal Corps. He was born March 17, 1888, at Danville, Va., and at the age of twenty was graduated from the Georgia School of Technology with the degree of B. S. in electrical engineering. For three years he taught electrical engineering at Pennsylvania State College. The next three and a half years were spent with the Marconi Wireless Telegraph Company in England and in Hawaii. When in Hawaii he was in charge of construction and operation of one of the world's largest radio stations. He then entered the employ of the Western Electric Company. In April, 1917, he was commissioned as major in the Signal Reserve Corps to take charge of development of radio apparatus and in December was promoted to lieutenant-colonel.

H. N. SLAUGHTER

James T. White, manager for the Oregon Gas & Electric Company at Roseburg, Ore., has been appointed to succeed O. R. C. Grow, resigned, as manager at Medford, Ore.

Henry G. Kobick, who has been with the Commonwealth Edison Company of Chicago for the last nine years, has resigned his position as superintendent of employment bureau to enter the aviation section of the Signal Corps, United States Army.

Arthur H. Savage, newly elected president of the South Dakota Electric Power Association, is a resident of St. Paul, Minn., and is treasurer of the Dakota Light & Power Company. He organized this company in 1912, and it commenced operations in August of that year, supplying the city of Flandreau, S. D. Mr. Savage was for thirteen years in charge of the Northwestern district as representative of the Fort Wayne Electric Works, severing his connection with that concern in 1914. He has since then been a manufacturer's agent for the sale of electrical machinery and central-station power plants.

Ralph E. Harris has been appointed successor to George W. Scott, resigned, as superintendent of the Warrenton (Ga.) municipal light and power plant.

J. A. Harnett, electrical engineer with the Western States Gas & Electric Company, has resigned to become connected with the Southern California Edison Company.

L. J. Porter has resigned as superintendent of the municipal water and light plant at Sandersville, Ga., to take charge of the municipal water and light plant at Waynesboro, Ga.

Charles H. Maxfield, superintendent of the Dexter district of the Central Maine Power Company, has taken charge of the Dover-Foxcroft office, of which W. G. Parker was formerly in charge.

A. D. Mackie, general manager of the Springfield (Ill.) Gas & Electric Company, has been appointed by Governor Lowden as a captain of infantry in the Fifth Regiment, Illinois Reserve Militia.

R. H. McKibbin, who has been with the Cerro de Pasco Mining Company at Pachachaca, Peru, for the past year on hydroelectric construction, is now electrical engineer for the Southwest Cotton Company at Phoenix, Ariz.

Fay Griffith, who has been superintendent of the lighting department of the Little Rock (Ark.) Railway & Electric Company, has been promoted to be superintendent of light and power and has taken over both the meter and line departments.

Clarence K. Beilharz, engineer in charge of operation of the steam and electrical plants of the Northwestern Ohio Light Company and for six years manager of the company at Delphos, Ohio, has been appointed manager of the Alva (Okla.) Light & Power Company.

A. A. Brown, formerly sales manager of the St. Paul division of the Northern States Power Company, who received a commission as first lieutenant on completion of the second Officers' Reserve training camp course, has been promoted to a captaincy and transferred to the Seventh Division engineers, Waco, Tex.

Ex-Senator John W. Slocum of Monmouth, N. J., has been elected president of the Board of Public Utility Commissioners, succeeding Lieut. Col. Ralph W. E. Donges, who recently resigned to devote his entire time to his duties as a member of the War Department Board of Appraisers. Mr. Slocum has been acting president of the commission.

D. C. Green, the president-elect of the Arkansas Public Utilities Association, is vice-president and general manager of the Fort Smith (Ark.) Light & Traction Company. Mr. Green was graduated from Purdue University with the class of 1908. After a brief experience with the Allis-Chalmers Company in its Cincinnati works he became associated with H. M. Byllesby & Company of Chicago. His experience with the Byllesby company has included such positions as manager of new business at San Diego, Cal., and manager at Albany, Ore., Marshfield, Ore., Everett, Wash., and Fort Smith, Ark. Mr. Green has been with the Byllesby organizations continuously since his first affiliation with them except for a period of about one year when he was connected with the Electric Bond & Share Company at Salt Lake City, Utah.

D. C. GREEN

Malcolm G. Chace of Providence, R. I., has been appointed Fuel Administrator for Rhode Island, succeeding George H. Holmes, resigned. Mr. Chace is a partner in the firm of Chace & Harriman, Boston, which has developed from their inception the hydroelectric systems now combined in the New England Power Company.

Obituary

Charles Christopher Trowbridge, assistant professor of physics, Columbia University, died suddenly on Monday of blood poisoning. Professor Trowbridge, who was forty-eight years old, had been a member of the Columbia faculty since 1892. Owing to his efforts in physical research the Ernest Kempton Adams Precision Laboratory was founded at Columbia six years ago. The laboratory was given to the university by Edward Dean Adams in memory of his son, and Professor Trowbridge planned the laboratory and developed the institution until at the present time it is considered one of the best-planned and best-equipped laboratories of its kind in the country. In it are kept instruments equipped to determine with the highest accuracy facts affecting electricity and kindred subjects.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

ELECTRICAL EXPORTS FOR MONTH OF MARCH, $5,147,921

Volume of Foreign Trade Is Falling Off, with Indications of Still Further Decrease in Future Months

Exports of electrical merchandise during the month of March last amounted to $5,147,921, as compared with $5,199,163 for March, 1917, During the month, however, there was a particularly large shipment of motors. This item reached a total of $785,233. Telephone exports also were large, amounting in all to $758,233.

During the nine months ended March last electrical exports reached a total of $39,921,619, as compared with $36,992,004 for the corresponding period of the previous year.

Electrical exports so far this year have been falling off in comparison with 1917, and with the most recent limitations on exports by the War Trade Board it seems very doubtful, unless the war comes to a close very quickly, that electrical exports will reach the total set last year. According to present indications, exports will be somewhere in the neighborhood of $40,000,0000 to $50,000,000 for the year 1918.

The figures in the accompanying table were compiled by the Bureau of Foreign and Domestic Commerce.

	March		Nine Months Ended March	
Articles	1917	1918	1917	1918
Batteries	$380,992	$289,251	$2,150,150	$2,502,333
Carbons	.....	181,617	.....	1,160,653
Dynamos and generators	132,760	269,409	1,876,824	1,803,378
Fans	18,004	65,643	272,768	428,419
Heating and cooking apparatus	.....	31,553	.....	397,352
Insulated wire and cables	719,639	536,247	5,277,206	4,574,597
Interior wiring supplies, including fixtures	80,579	129,703	776,775	1,116,983
Arc lamps	4,015	2,001	11,808	9,703
Carbon-filament lamps	12,505	8,840	109,455	125,952
Metal-filament lamps	176,577	236,817	1,224,751	2,119,690
Magnetos, spark plugs, etc.	.....	318,333	.....	2,608,501
Meters and measuring instruments	99,509	125,207	781,486	1,064,740
Motors	572,733	785,233	4,174,965	4,942,714
Rheostats and controllers	.....	29,429	.....	144,568
Switches and accessories	.....	222,338	.....	1,729,180
Telegraph apparatus, including wireless	135,775	15,429	327,487	214,132
Telephones	151,739	368,338	1,306,847	1,867,423
Transformers	116,347	95,325	856,793	1,399,793
All others	2,597,989	1,437,208	17,844,889	11,711,508
Total	$5,199,163	$5,147,921	$36,992,004	$39,921,619

NEW OFFICIAL SPECIFICATIONS FOR RED-CEDAR POLES

Revised Standards Are Issued by the Producers' Association for 4-In., 20-Ft. and Larger Poles of This Description

The Western Red Cedar Association, Spokane, Wash., has issued the following official specifications, as revised April 30 last, for Western red-cedar poles 4-in., 20 ft. and larger:

1. Live Timber.—All poles must be manufactured from live growing cedar timber.

2. Manufacture.—All poles must be peeled, knots trimmed close and butts and tops sawed square.

3. Variation in Length.—Poles may be 6 in. longer or 3 in. shorter than length specified.

4. Knots.—Knots are not a defect if they are sound, trimmed smoothly and do not plainly impair the strength of the pole.

5. Discoloration.—Discoloration is not a defect.

TABLE NO. 1—MINIMUM TOP MEASUREMENT

Top Designation	Circumference, In.
4-in. top	12
5-in. top	15
6-in. top	18½
7-in. top	22
8-in. top	25
9-in. top	28
10-in. top	31

6. Miscellaneous Defects.—No poles shall contain sap rot, woodpecker holes, plugged holes or evidence of having been eaten by ants.

7. Rot.—Tops of poles must be free from rot. Butt rot in center, including small ring rot, shall not exceed 10 per cent of the area of the butt. Butt rot of a character which impairs the strength of the pole above the ground line is a defect.

TABLE NO. 2—MINIMUM BUTT MEASUREMENT

Poles 35 ft. and longer shall have a minimum circumference measurement at extreme butt as follows:

Length, Ft.	7-In. Top, In.	8-In. Top, In.	9-In. Top, In.	10-In. Top, In.
25	33	36	39	42
40	34	37	40	44
45		39	42	45
50		41	44	47
55		42	45	48
60		44	47	50
65		45	48	51
70		47	50	53
75		48	51	54
80		50	53	56
85		51	54	57
90		52	55	58

8. Cat Faces.—Sound cat faces are not a defect if no part of the cat face shows on the upper one-fifth of the length of the pole or within 2 ft. above or 1 ft. below the ground line.

9. Dead or Dry Streaks.—A sound dead or dry streak is not a defect if it does not cover more than 25 per cent of the surface of the pole at any one point.

10. Minimum Measurements.—(a) The tops of all poles shall have a minimum circumference measurement as shown in Table No. 1. (b) The extreme butt of all poles shall have a minimum measurement as shown in Table No. 2. (c) Poles having a decided swell or flare at the butt shall have a sufficiently larger measurement at butt to insure a reasonable measurement at the ground line.

TABLE NO. 3—MAXIMUM ONE-WAY SWEEP

Length of Pole, Ft.	Maximum Sweep Between Top and Ground Line, In.
20	3
25	3
30	4
35	5
40	5½
45	6
50	7
55	8
60	9
65	10
70	10½
75	11
80	12
85	13
90	14

11. Short Kinks.—Short kinks are not permitted.

12. Reverse Sweep.—Reverse sweep and two-way sweep, meaning a sweep in two planes, is permitted, provided a

straight line drawn from the center of pole at top to center of pole at ground line does not leave the pole at any point.

13. One-Way Sweep.—One-way sweep is permitted provided it does not exceed maximum shown in Table No. 3.

14. Method of Measuring Sweep.—That part of the pole below the ground line not to be taken into consideration. Tightly stretch a tape line from point at ground line (see paragraph 15) on the side of the pole where the sweep is greatest to the upper surface at the top of the pole, and having so done, measure widest point from tape to surface of pole and if, for illustration, upon a 30-ft. pole the widest point does not exceed 4 in., this pole shall be accepted.

15. Explanation of Term "Ground Line."—The term "ground line" as used in these specifications shall mean a point on the pole a distance of 4 ft. on 20-ft., 5 ft. on 25-ft. and 30-ft. and 6 ft. on 35-ft. and longer poles from the extreme butt.

HIGHER PRICES PUT ON ELECTRICAL APPARATUS

Motors, Switchboards, Turbines, Transformers and Generators Are Marked Up 10 per Cent—Selling Terms Stricter

Within the past ten days numerous announcements of advances in power-plant equipment have come out from the manufacturers. A general advance of 10 per cent on motors was made in the neighborhood of June 1. One of the leading manufacturing concerns sent the following notice to its agents:

"Effective Saturday noon, May 18, advance net selling price 10 per cent on all lines covered by apparatus, switchboard, turbine and motor price book sheets dated prior to May 16, pending receipt of revised price sheets or discounts."

Another company of prominence made the switchboard advance about the middle of May; but on motors of all sizes, alternating and direct current; transformers, generators and motor-generator sets its new prices went into effect June 3. Transformers, electric locomotives and some other specialties were made exceptions under the new ruling by the first-named concern. Special motor manufacturers in some cases also exempted fractional motors. Their lists became effective June 1.

It is held by the various manufacturers that a steady advance in the cost of material has rendered the increase in finished goods imperative. Further, it is also the opinion of several large producers who adjust their operations strictly on market and general conditions that a mark-up in a couple of months on all lines of electrical supplies should be no cause for special astonishment. The manufacturing situation, for obvious reasons, has been getting more acute within the last few months. It is safe to say, according to authorized statements, that with the still further anticipated scarcity and difficulty of obtaining material, shortage of skilled labor and other drastic contingencies, conditions are speculative and far from stable or certain. Therefore it is hard to tell what may occur.

With possibly one exception, the manufacturers have a standing rule of "price subject to change without notice," applicable to current buying and ordering. This concern stipulates that a leeway of fifteen days be allowed on all acceptance orders. For a while this clause was more or less loosely construed, but recently the trade was notified that it would be strictly enforced.

In the past it was the general practice in this branch of the industry to inform the trade in advance of a price increase. It was found, however, that some of the larger jobbers immediately proceeded to "load up" with goods to the disadvantage and detriment of the smaller buyers. In fact, it is said that several attempts were made to corner the market on motors. The factories were swamped with orders, and to protect the trade and check this tendency it was necessary to establish a system of allocation. This led up to the present method of wiring agents or house representatives of any change as being immediately effective, with no general notice to the trade. Buyers, under the circumstances, were uninformed until they actually came into the market.

THE WEEK IN TRADE

ADVANCING prices have been discussed and looked for in all parts of the country. Conditions due to the war are constantly changing, with almost kaleidoscopic effect. The actual happenings along this line justify expectations, for recently prices have actually been advanced on motors, turbines, transformers, generators and switchboards by the principal manufacturers. Some of the announcements became effective the middle of May, with the more recent dating from this week. It is even hinted that a further increase on general supplies may be looked for in a couple of months.

The shortage in conduit has not been overcome, New England points being in slightly better shape on some types. In the Far West substitution on color and size is in order. Fans are in active movement, distributers and jobbers who were forehanded in contracting for liberal stocks reaping the benefit of sound judgment, and supplies are being absorbed rapidly. Everywhere shipping delays are inconveniencing all branches of the trade, and no decided improvement is expected in the near future. The new increase in freight rates, effective June 25, is causing no little concern, particularly among jobbers distant from the factories.

Collections are reported as satisfactory in some sections and falling behind in others. An improvement is looked for. Credits are receiving close attention.

NEW YORK

Business in all departments of the electrical trade during the past week has been excellent. Occasional reports of a low supply or shortage of some staples are heard. As yet, however, no uneasiness is felt. Jobbers and distributers have in not a few instances anticipated their requirements for the fall and winter as much as possible. Manufacturers are not disposed to accept other than the usual orders from any one at the present time. They will do their utmost to take the best care of the old, steady customers, but new trade, unless gilt-edge and of the best repute, must take chances.

Some changes in prices were made, especially on motors, while mysterious suggestions of sharp increases on other lines are afloat. Collections represent a strong average, with credits held along an undeviating line of firmness.

WIRE.—Rubber-covered wire has hardened in price, an advance of from 2½ to 3 per cent being ordered by the manufacturers. The American Steel & Wire Company advanced the base price to 31 cents a pound.

DRY BATTERIES.—Stocks are in fair condition, and the demand is active. The high price of solder has not as yet influenced the dry-battery producers to change their prices. If this necessary material suffers a few more mark-ups—there have been drastic changes in the mill prices—an advance on the finished goods would be no surprise.

CONDUIT.—Jobbers report all sizes of conduit as being short in supply, with general stocks becoming weaker. The latest news from the mills is not reassuring by any means. Some producers are pushing their plants to the limit for output, and others have been required to curtail their operations to release steel for more pressing needs in war material.

PORCELAIN.—General report, which reflects current opinion, says that porcelain is hard to get. No advance in prices has materialized, though for a month reports of this tenor have been discussed by jobbers in the East. The government's requirements are still heavy, leaving little for commercial purposes.

COLLECTIONS AND CREDITS.—Credit men with leading jobbers and distributers state that collections are steadily

improving, the week's record being at least 5 per cent better than at the close of May. Credits are closely watched, with new accounts rigorously handled.

MOTORS.—Sizes from 25 hp. to 50 hp. are difficult to obtain. Within the past two weeks a number of the more prominent manufacturers have advanced their prices 10 per cent. One of them announces also that hereafter adherence to the fifteen-day price acceptance clause will be rigidly enforced.

HOUSEHOLD APPLIANCES.—Prominent New York department stores say that during the past few weeks their sales on household appliances, especially tableware, were not only very satisfactory but in some instances broke previous records. Sewing and washing machines led the list.

WIRING DEVICES.—Jobbers report a fair sale of wiring devices, particularly for suburban homes. The slump in building operations has worked havoc with the call for these staples, but there is still quite a movement. New England manufacturers are running their plants up to capacity on government orders.

SOCKETS.—Standard lamp sockets are said to be selling as well as could be expected at this time of year.

LAMPS.—The factories claim to have strong stocks on all the standard numbers, but have not yet quite caught up on miniatures. They are making good progress, and in a couple of weeks believe they will be on an even footing. Deliveries are shorter.

CHICAGO

The opinion of jobbers seems to be that while business is holding up fairly well, it is at this time rather unsettled and is in a state which makes it difficult to predict what the future will bring. The general plan followed by these distributers in the present market is to discover those points which are now most active and to make a special effort to keep sales representatives on the job at these points during as much of the time as possible. Prices still continue to increase.

The city of Chicago is still without a great deal of war work that it might handle if the government were convinced that the labor situation was bearable. Business men who are interested in getting war factories to come to Chicago feel very strongly that a strenuous effort should be made to get some sort of an understanding with labor which would permit the city to take care of its share of the country's war program.

Railroads are only buying from "hand to mouth." All have made up their budgets and, according to the newspapers, have been told how much they can spend in the coming year. None of the roads in this territory, however, has yet had official announcement on this point. While business with the roads is not so good now as it should be, it is momentarily expected that something will open up in this line.

In Chicago shipbuilding activities largely consist of making over passenger vessels into freight vessels and doing other repairs. The buying for some of this work is being done in Cleveland. Further north along Lake Michigan the activity is more intense, and Chicago and Milwaukee jobbers are securing some of this business.

LAMPS.—Distributers report that stocks are accumulating on all sizes except 75-watt. This does not apply to the miniature lamp business, where the shortage of stock still is acute.

WIRE.—Rubber-covered wire has advanced about 10 per cent.

CONDUIT.—The situation in the metal conduit field is still bad. It is most essential now to be able to tell where conduit is going before it can be secured, as there is a tendency to curtail the use of this class of goods in any except war work.

SCHEDULE MATERIAL.—There has been an increase in this class of goods which amounts in the aggregate to about 8 per cent.

FANS.—Even as far north as Chicago jobbers report that fans are moving in good fashion. Further south the activity in this class of goods is reported to be still better.

INDUSTRIAL LIGHTING FIXTURES.—Sales are bigger this spring than last, indicating that the operators of plants which have night shifts are breaking over the seasonable precedent and are buying fixtures right through the summer.

BOSTON

No let-up is to be seen in the volume of trade, speaking generally. This is a natural result of the accelerating war preparations of industrial New England, which are throwing a flood of orders upon jobbers and which are giving the contractor some important work in the way of plant remodeling, extensions and some new construction. The pressing claims of war funds are influencing collections a little unfavorably. Trade acceptances are being used with good results between jobbers and contractors, but credits are being very carefully watched. Transportation congestion is very serious in spite of open-weather conditions. Work is progressing rapidly at the army and naval bases, and the shortage of labor reported last week tends to grow more and more acute. There is a good deal of unrest in the textile industry at present, but in the main labor seems to be continually employed, although the turnover is abnormally high. A 10 per cent advance in prices took effect June 1 on Lincoln motors, otherwise prices are showing little change.

FANS.—The retail trade is picking up rapidly, and some dealers report an unusually heavy demand for fans, despite increased prices. Jobbers are well stocked, and one house reports fan sales of over $2,000 so far this season. Another house has received nearly 8000 fans from the factories and notes a larger demand from the distributers in the retail trade than at this time a year ago. Some buying for summer homes is in evidence.

STORAGE BATTERIES.—The automobile trade is buying heavily, especially for renewal business. Stocks are still pretty well prepared for this call, but there is some question how long orders can be filled immediately upon receipt, owing to railroad congestion and enormous government demands. No price changes have been heard of since April.

LAMPS.—As the central-station demand sags off stocks are increasing somewhat. A shortage is reported in miniature sizes, factories being from three to six months behind on orders. Ordinary sizes are now well in hand, and if the anticipated coal-saving campaign develops as expected, conditions should be much easier this fall than during the past winter.

FIRE-ALARM APPARATUS.—A substantial demand is reported at present for protective equipment for industrial plant service. One maker reports that he has more orders on his books than he can fill.

MOTORS.—Prices remain steady, with the exeception of a 10 per cent advance by the Lincoln Electric Company dating from June 1. Government commandeering of steel and labor scarcity are factors in the increase. Delays in shipments are proving troublesome. One dealer reports that he has received no motors for stock additions since the last of April, and that an important shipment has been three weeks en route between New York and Boston. The demand for alternating-current motors seems to predominate.

ELECTRIC WELDING APPARATUS.—Increasing interest in this equipment is noted in New England, and the outlook is exceptionally good for its use in shipyard, railroad and metal repair shop service.

CONDUIT.—Rigid pipe is plentiful in sizes up to and including ¾-in., but above this it is very difficult to obtain deliveries even on quasi-government work. The demand for larger-sized pipe continues heavy in connection with war-service plants, where first-class wiring now appears to be an essential on account of the severe working conditions present.

SMALL STEAM TURBINES.—Few commercial orders, so called, are being received at present in comparison with naval requirements. Quotations for commercial delivery give little hope of meeting the purchaser's requirements in less than five months.

APPLIANCES.—A Boston department store reports exceptionally active sales in percolators and curling irons. Small electric cooking devices in general are in good demand. Few central stations are doing much with ranges at the moment, but here and there sales are being recorded even of large units.

ATLANTA

Jacksonville, Fla., has been named as one of the locations for the establishment of yards for the construction of concrete ships. Official announcement covering details will be available very soon. For those that have been following the rapid expansion and influx of population at Southeastern coastal cities, it will be of interest to note the announcement of the War Department to the effect that the Butterworth-Judson Corporation of New York City has secured a contract to erect a plant for the manufacture of picric acid on Turtle Island, three miles from Brunswick, Ga., costing $7,000,000. The plant itself will cost $5,000,000 and the industrial city $2,000,000.

These developments will have a tendency to stimulate sales in all electrical staples and to expand the market for marine supplies at Jacksonville and heavy apparatus at Brunswick. The Marion Coal & Lumber Company of Chattanooga, Tenn., has been incorporated for $1,000,000. This company will open up timber and coal land, accelerating the market for electric locomotives, generating apparatus and miscellaneous equipment.

FANS.—The hot wave this week has started a heavy movement of fans to all outlying sections, the demand for all sizes being strong. A large number of the ceiling type are being used locally. A few jobbers' stocks are in excellent shape, but others are experiencing great difficulty with the transportation problem. Shipments received are absorbed before stocks have a chance to accumulate.

AUTOMOBILE SUPPLIES.—There is no cessation in the call for spotlights, and prompt deliveries are made in the face of this pressure. The demand continues for miniature lamps, with some improvement in shipments, which is accounted for by the jobbers by the fact that factories are getting ahead with stocks.

ENTRANCE CUT-OUTS.—Stocks are very good considering the heavy draft that is evidenced by an ever-swelling volume of business.

LABOR-SAVING DEVICES.—Sewing-machine motors are moving freely. A brisk trade has been done this week in washing machines, dish-washers and churns. While vacuum cleaners are not quite so active, a satisfactory volume of business is being transacted for this time of the year.

ELECTRIC RANGES.—Manufacturers and jobbers report a very good business in these, the states most active being Florida and South Carolina. The latter State handles the larger volume at this time.

SEATTLE

In spite of holiday sales the volume of business for the past week nearly equaled that of the week previous. The volume to shipyards and industrials was maintained but there was a slight decrease in commercial business. Government buying too, was noticeably less. Freight from Eastern factories is subject to serious delays, and local jobbers are considerably inconvenienced. Jobbers have practically given up hope of improvement. Mix-ups and delays in L. C. L. shipments are the rule. Outgoing freight, both rail and steamship, is terribly congested. A slight impetus in sales of power apparatus, particularly of the smaller-size motors, is noted. There has been no change in price of any consequence. Dealers are apprehensive about an announced increase of 25 per cent in freight rates and are anxiously awaiting specific information.

As usual, activities pertaining to the Puget Sound, Gray's Harbor and Columbia River shipyards command the center of the stage, aside from actual shipbuilding, which is going on night and day. During the first five months of the year the Seattle yards have launched twenty-two steel ships, aggregating 180,400 deadweight tons, all for the Shipping Board. In addition, one wooden steamship for the government and seven wooden ships for foreign governments and private interests were launched during the week. The Shipping Board awarded contracts to the Seattle yards involving $31,000,000. The contracts are for nineteen 8800-ton steel freighters. In less than a month the Shipping Board has added more than $130,000,000 to Seattle's shipbuilding contracts. The yards obtaining the above contracts will make enormous extensions to the present establishments.

Portland reports that the supply of vacant dwellings is exhausted and the demand increasing daily. In spite of increased building activity in residence sections, towns in the Gray's Harbor district to date have been unable to meet urgent demands for housing. Record residence construction in Seattle and Tacoma continues unabated, notwithstanding the excessive costs of materials. New business accepted by the West Coast lumber manufacturers during the past week was the greatest for any single week in more than six months.

Seattle retailers report fixture and small domestic appliance sales for the past week very satisfactory. In spite of the holiday considerable out-of-town business was received, particularly from Bremerton, where unprecedented residence building is under way. Local retail sales were on an equal level with the past few weeks. Conduit shortage is extremely acute. Shipyards, the principal users, are forced in many cases to resort to substitution. For instance, if black cannot be obtained white will be used, and the same applies in sizes. Substitution is also practiced in the larger type of lamps. The scarcity of the smaller lamps is practically overcome. The lamp sales in all sizes to shipyards have increased considerably over the past month.

METAL MARKET SITUATION

Orders and Deliveries on Copper Closely Scrutinized —Tin Coming in Stronger

Apparently there is no trouble in getting all the copper needed for commercial consumption, although deliveries are uncertain. No complaint is heard on the part of wire and cable producers that the metal is difficult to obtain in any reasonable quantity when its purpose is disclosed to the official distribution committee. It is said the producers continue to book domestic orders with reluctance and great circumspection and shipments are closely looked after. The jump in the price of zinc by government designation was a surprise to outsiders. Tin is reaching this market in better quantities.

The new maximum base price for aluminum, effective June 1 to Sept. 1, has been fixed by the President at 33 cents a pound, under an agreement between producers and the War Industries Board. This figure applies to the ingot of 98 to 99 per cent grade in lots of 50 tons or more. Differentials for sheet, rod and wire will be increased about 12½ per cent. Advances in freight rates on June 25 may affect future prices on steel following June 30.

NEW YORK METAL MARKET PRICES

	May 27	June 3
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25 to 26.75	26.25
Lead, trust price	7.00	7.00
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	7.35 to 7.45	7.40 to 7.50
Tin, Chinese*	$1.02	$0.86
Aluminum, 98 to 99 per cent.	Govt. price †32.10	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 13.75	13.50 to 13.75
Brass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	6.00 to 6.25	5.75 to 6.00
Zinc, old scrap	5.50 to 5.75	5.50 to 5.75

*No Straits offering. †In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List to 15%
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List to 120.00
Coil to 1000 ft	$93.60 to $100.00
	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	15% to + 10%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	15% to + 10%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/ to std. pkg	20%
Std. pkg.	34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10% to 20%
1/5 to std. pkg	List to 20%
Std. pkg	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.285	.295

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$.40	$0.40
12 to 50	.35	.35
50 to barrel	.3190-.32	.3290-.33
Barrel lots	.2890-.29	.2990-.30

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	**26.00**
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	List to $82.50	$63.75 to $67.50
3/8-in. d. stp.	$82.50 to 84.00	69.00 to 75.00
1/2-in. s. stp.	List to 110.00	85.00 to 90.00
1/2-in. d. stp.	110.00 to 112.00	92.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	List	$63.75
3/8-in. double strip	78.25-78.75	71.25-71.75
1/2-in. single strip	List	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25.00-$55.00	$20.50-$26.00	$20.00-$24.00
1/4-in.—	$28.00-$60.00	$22.50-$28.20	$22.00-$26.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$36.00-$55.00	$25.00	$22.50
1/4-in.—	$40.00-$60.00	27.00	25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 12%	7% to 14%
2500 to 5000 lb.	6% to 15%	9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	6.8% to 7.3%	9.8% to 10.7%
2500–5000 lb.	8.8% to 9.3%	11.8% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $6.30
1/5 to std. pkg.	4.50 to 5.25
Standard packages, 500. List, each	$0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$7.00
1/5 to std. pkg.	5.75
Standard packages, 500. List, each	$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3½-in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾-in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅝-in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$31.00 to $34.90
Coil to 1000 ft	24.98 to 26.20

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft)	$29.00 to $30.00
Coil to 1000 ft	21.50 to 25.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$20.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½ 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.80
1/5 to std. pkg	14.80

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$15.80
1/5 to std. pkg	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg	$11.85	$30.70 to $30.75
1/5 to std. pkg	11.10	24.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg	$11.85	$30.75
1/5 to std. pkg	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	List to + 10%
1/5 to std. pkg	8% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg	10% to 29.70 cts.
1/5 std. pkg	20% to 26.40 cts.

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11% to 12%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 20%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 5%
$10 to $25 list	10% to 11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	List to + 10%
1/5 to std. pkg	8% to 15%
Std. pkg	25% to 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to + 20%
1/5 to std. pkg	List to 20%
Std. pkg	List to 28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40%	30%
$2.00 to $10.00 list	50%	40%
$10.00 to $50.00 list	64%	52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	20%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$5.50 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	41.25-0.44¼
No. 18, full spools	36.25-0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.60-$0.65
No. 18, full spools	0.50- 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-$18.00	$12.50-$14.00	$9.85-$12.25
12	23.25- 25.40	19.96- 21.80	15.95- 19.35
10	32.40- 35.20	27.66- 20.20	22.10- 27.00
8	45.63- 49.15	38.66- 42.10	30.85- 38.00
6	72.40- 77.85	61.71- 66.75	48.95- 60.30

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00	$13.00	$11.50
12	25.69-$25.69	22.02-$25.33	18.55-$20.40
10	20.49- 35.04	27.94- 30.03	22.86- 28.23
8	42.54- 48.97	38.99- 41.98	31.90- 39.42
6	66.46- 67.38	56.15- 62.43	50.53- 56.39

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$35.25 to $36.85
25 to 50 lb	34.40 to 36.85
50 to 100 lb	30.40 to 36.10

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$37.43 to $40.00
25 to 50 lb	36.43 to 39.00
50 to 100 lb	35.43 to 38.00

NEW APPARATUS & APPLIANCES

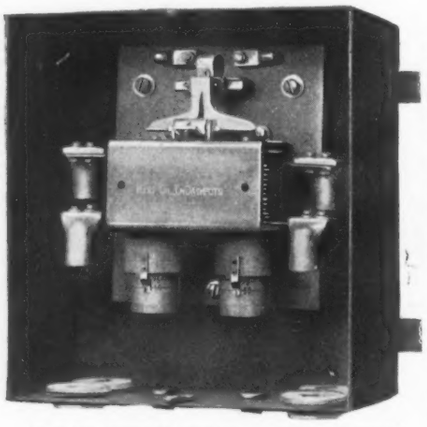
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Inclosed Overload Safety Relay

Protection against overload for alternating-current motors equipped with starters or switches having low-voltage protection is afforded by a relay manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The relay is inclosed in a sheet-steel case which excludes dust and foreign particles of all kinds. The cover of this case is secured by two thumb screws and is provided with a safety device which automatically trips the relay when the cover is removed, thus rendering all parts of the relay "dead" as long as the cover remains off. This facilitates inspection and repairs. The relay operates by means of magnet coils which are inactive at loads less than that for which they are set. When the current value reaches or exceeds this setting the coils lift plungers which break the control circuit and operate the low-voltage relay to open the line circuit. With no current flowing in the line the coils are de-energized and the relay is automatically reset, the bridge being pressed against the contacts by means of a compression spring. The plungers operate in oil dash-pots, providing a time element which allows the relay to carry a momentary overload without tripping.

This time limit is adjustable by means of a small perforated disk in the dash-pot which is readily accessible by unscrewing the dash-pot from the casting which holds it. To prevent accidental change of adjustment from vibration or jar a spring lock is provided which holds the dash-pot firmly in place. The safety device by which the relay is tripped on removal of the cover is a flat looped spring which when free to act holds the contact bridge away from the contacts. When the cover is fastened in place this spring is depressed by a pin on the cover, thus allowing the contact to be made between the contacts and the bridge. These relays are made in all commercial frequencies and voltages and in capacities of 5 amp. to 300 amp.



RELAY AUTOMATICALLY TRIPS WHEN STEEL COVER IS REMOVED

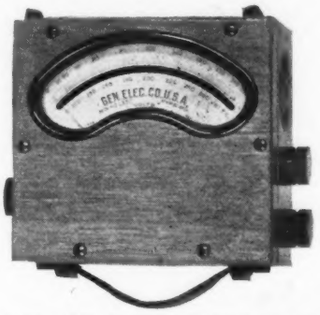
Motor-Driven Gasoline Sprayer for Automobiles

A small portable machine for spraying gasoline as a cleaning medium is being manufactured by the Midvale Machine Works, St. Louis, Mo. This machine can be used for applying waterproofing or finishing coats to automobile tops or for repainting wire or wood wheels. It also finds application for quickly applying any liquid to automobile bodies or metal parts. The machine consists of a Midvale-type duplex-cylinder compressor mounted on a portable roller base, with an air-pressure tank, air cleanser and renovator, relief pressure valve, 6 ft. (1.8 m.) of rubber tubing, an air cock and a vapor gun with a glass cup container. The outfit complete weighs 190 lb. (86.1 kg.).

PORTABLE MACHINE WEIGHS 190 LB. COMPLETE

Small Testing Instrument

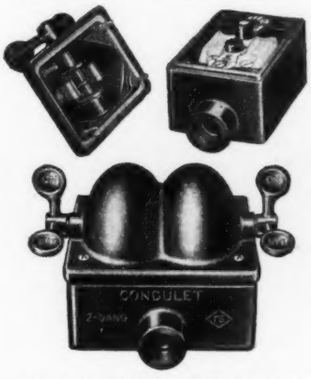
Light-weight and small testing ammeters, voltmeters and wattmeters for alternating and direct current of the dynamometer type have been placed upon the market by the General Electric Company of Schenectady, N. Y. The manufacturers claim that these are the smallest and lightest practical sets of instruments on the market that are applicable to all commercial frequencies and wave forms without appreciable error. These ammeters and wattmeters are furnished only for series current rating up to and including 20 amp. The wattmeter is single-phase, but can be furnished with double voltage potentials if desired. The ammeter is of the iron vane type. The windings are magnetically shielded and equipped with an air damper. The instrument case with a window in the cover over the scale plate forms the carrying case. The dimensions of the instrument are approximately 4.75 in. by 4.37 in. by 2.6 in. (12 cm. by 11.1 cm. by 6.5 cm.). Voltmeters and wattmeters of this type for 600 volts have also been developed. The cases in these instruments, however, are slightly larger to care for the additional resistance.



SMALL AND LIGHT-WEIGHT TESTING WATTMETER MAY BE EASILY CARRIED

Serviceable Cover for Push-Button Switches

The liability of moisture, gas or dust getting into the operating parts of push-button switches is entirely eliminated, according to the Crouse-Hinds Company, Syracuse, N. Y., in a cover that it has recently placed upon the market. This device is designed to be installed in one-gang or two-gang condulets of either the FS or FD series, and it consists of a cover with a switch-operating mechanism. Like the con-



BEARINGS ARE WELL SEALED WITH A HARD GREASE

dulet, the cover is a casting, either iron or brass as specified. The mechanism which operates the push-button is under the dome of the cover and is controlled by a shaft flattened at its inner end and extending through the side of the cover, where it terminates in the operating handle. That portion of the shaft which passes through the cover is provided with grooves containing hard grease which effectually seals the bearing, and a rubber gasket likewise seals the joint between the cover and the condulet. On-and-off indicators cast on the ends of the handle facilitate the operation of the switch.

With this cover and the necessary condulet it is now practicable to use push-button switches in places where excessive moisture, explosive or corrosive vapor or fine dust circulates in the atmosphere, as in ships, ammunition plants, refineries, textile and flour mills.

Industrial Tractors

A line of electric tractors for use in factories, shops, etc., has been placed upon the market by the Industrial Truck Company, Holyoke, Mass. The tractors are manufactured in two types with end or center control and with either two-wheel or four-wheel drives as desired. Removable side doors are provided for changing batteries, and the inner top plates on the tractor allow easy access for flushing or inspection. The battery equipment is of the Edison or lead-plate type as desired. The frame and battery box can be lifted from the cabinet, leaving the entire driving mechanism accessible for inspection or repair. Power is transmitted from the motors to a single reduction worm and gear differential and a universal joint to the wheels. The universal joint is inclosed in a dust-proof and oil-proof case, and it is capable of operating at an angle of 43 deg. Two brakes are provided, one operated by the left foot and the other operated by the right. To operate the tractor the driver must be sitting in the seat

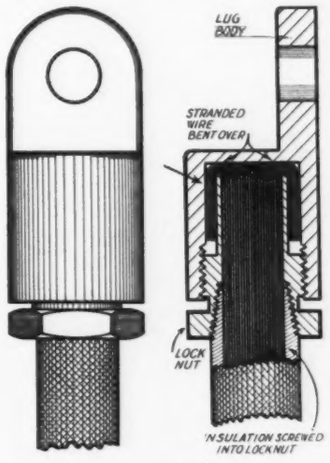
TRACTOR WITH COMPLETE ARRANGEMENTS FOR SAFETY

with his left foot pressing on the emergency brake pedal. On removing the foot from the left pedal the brake is applied, the controller handle is thrown off, and the controller is placed in neutral position. After this has happened it is impossible to start again without first releasing the emergency brake and bringing the controller back to neutral.

An additional safety device is found in the tilting steering wheel, which is so placed that the operator must tilt the wheel to leave his seat. This arrangement is connected with the controller shaft clutch so that the battery current cannot be applied until the wheel is in running position.

Solderless Wire Terminal

Great conductive capacity is obtained by a solderless terminal that has been placed upon the market by the Cruban Machine & Steel Corporation, 2 Rector Street, New York City. Each strand of the cable comes in direct contact with the lug body. An absolutely firm contact is obtained, and it is impossible to pull out the wire without destroying either the lug or the wire. The wire can be taken out of the lug without injuring the wire or the lug. The grip of this lug is in no way affected by excessive heating. The cross-section in the illustrations shows the body, the lock nut and the cable. The wire strands of the cable are bent back on to the smooth part of the lock nut. To attach, the end of the cable must be cleaned of all insulation for about 9/16 in. (14.3 mm.). The insulated part is then slightly tapered on the edge, so that the lock nut can be screwed in over the insulation as shown in the figure. This connector is known as the "Cruban" solderless wire terminal, and may be used wherever stranded conductors are in service.

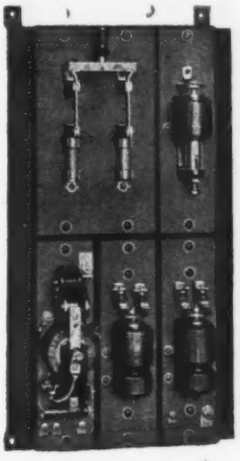


WIRE CANNOT BE PULLED OUT WITHOUT INJURING LUG OR CONDUCTOR

Current-Limit Automatic Controller for Motors

An automatic controller consisting of a number of lock-out accelerating switches having series-wound coils has been placed upon the market by the Industrial Controller Company of Milwaukee, Wis. The rate at which the motor accelerates up to full speed is limited by the current in the armature—under light loads the motor will start rapidly, under heavy loads more slowly. The motor will accelerate to full speed in the quickest possible time consistent with safety.

This device is known as a "unit panel



COMPLETE UNIT-PANEL CONSTRUCTION CONTROLLER FOR ACCELERATING MOTORS

construction" controller—that is, each accelerating unit, contactor, overload relay and knife switch which may be used with the complete controller is mounted on a separate panel. The panels are in turn mounted on a frame completing the controller. Each of the accelerating unit panels also carries the necessary resistance units. This panel construction permits very easy replacement or additions.

Solid copper contact fingers are furnished with these controllers, laminated brushes being entirely eliminated. The controllers are arranged so that inclosing covers may be easily attached to the standard frames when desired. These controllers are particularly adapted for use with all types of machine tools, centrifugal pumps and fans, blowers, etc.

Platform Electric Washer

Lifting of water is eliminated in a platform electric washer that has been placed upon the market by Voss Brothers Manufacturing Company, Davenport, Iowa. The washer is placed on one end of the platform with the motor on a shelf immediately beneath it. Tubs for hot and cold water can also be placed upon the platform, and the wringer is placed at the opposite end with a basket for receiving the dry clothes. The wringer is operated by means of a rod drive parallel to the platform. To drain the wash tub and rinse tub when through washing it is only necessary to open the pipe in the wash tub and pull the plug at the bottom of the rinse tub. The double wringer control allows the operator to control the wringer either by hand or by the foot pedal at the bottom of the machine. While using the foot pedal the operator has both hands free to handle the clothing.

Trade Notes

JOHN F. GODFREY, manufacturer of coal-handling conveyors, has removed his plant from Elkhart, Ind., to Chicago.

THE KILO ELECTRIC METER COMPANY has removed its plant from Indianapolis to Richmond, Ind. Its capitalization will be $125,000.

THE MOLONEY ELECTRIC COMPANY, St. Louis, Mo., announces that J. Van Buskirk, formerly associated with the Minerallac Company of Chicago, has just been appointed manager of the Chicago office.

THE ELECTRICAL ENGINEER'S EQUIPMENT COMPANY of Chicago has appointed the Beedle Equipment Company, 1309 and 1310 Union Trust Building, Cincinnati, Ohio, district representative for that city and the surrounding territory.

THE DETROIT ELECTRIC SALES & SERVICE COMPANY of Detroit, Mich., is erecting a new building, an addition to its plant, two stories high and 200 ft. by 400 ft. in size. When completed the company will have 160,000 additional sq. ft. of floor space.

THE JEFFREY DEWITT INSULATOR COMPANY, the new corporate name of what was formerly the Dewitt-Jeffrey Company, manufacturer of the J-D high-tension suspension insulator, will be operating its new plant at Kenova, W. Va., on June 1. Its offices will be in the first National Bank Building, Huntington, W. Va.

THE HOLTZER-CABOT ELECTRIC COMPANY, Roxbury, Mass., announces that its business in motors, dynamos, motor-generators, etc., previously conducted by the James Goldmark Company, 83 Warren Street, will be hereafter handled from its New York office at 101 Park Avenue, corner of East Fortieth Street. Douglas Cairns is in charge of the New York office.

J. EECKEL, secretary of the Ministère de l'Industrie et du Travail, 15 Boulevard de Strasbourg, Havre, France, requests American manufacturers of electrical apparatus, machinery, supplies and specialties to send him their catalogs, together with such technical information as might be useful or interesting to future possible buyers. These catalogs will be filed and indexed, and placed at the disposal of Belgian manufacturers and buyers as soon as the war is over.

THE HOOVER SUCTION SWEEPER COMPANY of New Berlin, Ohio, still has its plant and general offices in that place, now known as North Canton. Owing to the prejudice against German names and at the request of its people, the name of the town, which is virtually a suburb of Canton, has been changed as just indicated. From July 8 to 13 a meeting of the twelve division sales managers will be held at the Hoover company's factory, and it is understood that one of the main topics to be discussed will be that of prices.

COMMERCIAL AGREEMENT WITH NORWAY.—The War Trade Board announces that in consequence of the conclusion of a general commercial agreement with Norway exports of commodities embraced in the schedules attached to the agreement are about to be resumed. Exports from the United States will be licensed subject to the general policy of conservation and to the general rules and regulations of the War Trade Board. Shipments will only be made on vessels flying the Norwegian flag and the total exports are limited in quantity.

THE AMERICAN TRADE ACCEPTANCE COUNCIL of New York City will hold a special all-day trade acceptance session at the LaSalle Hotel, Chicago, on June 17. The National Association of Credit Men will also hold its annual convention at the same hotel on the preceding day. Paul Warburg, deputy governor of the Federal Reserve Board, will address the trade acceptance meeting. A representative attendance is expected of the trade acceptance committee men of the forty-eight state banking associations and committeemen appointed in the various industries, also of officers and directors of the more prominent trade and commercial organizations, besides leading bankers, manufacturers, merchants and students of economics.

THE GENERAL VEHICLE COMPANY, INC., and the Walker Vehicle Company make the following announcement: "On account of the existing national emergency it has become imperative, in the interest of winning the war, that the General Vehicle Company, Inc., vacate the plant at Long Island City. In order to conserve the interests of the many users of G. V. trucks, the General Vehicle Company, Inc., has made arrangements with the Walker Vehicle Company, Inc., of Chicago, Ill., to supply spare and repair parts and to furnish repair service to users of G. V. trucks. It is expected that this arrangement will result in the same satisfaction to G. V. users that they have enjoyed in the past. In general, stocks of spare parts will be carried as requirements determine, the principal stock being carried in Long Island City. After this date will you please communicate with the nearest Walker branch or dealer for parts or service."

Trade Publications

SWITCHES.—The Matthews "fuswitch" is described in a circular distributed by W. N. Matthews & Brother, Inc., 3727 Forest Park Boulevard, St. Louis, Mo.

WIRE TERMINALS.—The Cruban Machine & Steel Corporation, 2 Rector Street, New York City, has issued a circular describing its solderless wire terminal.

RHEOSTATS.—Universal battery-charging rheostats for garage duty are described in circular No. 501, issued by the Ward Leonard Electric Company of Mount Vernon, N. Y.

LAMP RENEWERS.—Lamp renewers for both series and multiple lamps are illustrated and described in a circular issued by the G. C. A. Manufacturing Company of Pittsfield, Mass.

PORTABLE INSTRUMENTS.—The General Electric Company of Schenectady, N. Y., has issued bulletin No. 46,018A, describing and illustrating its type P-8 voltmeter, wattmeter and ammeter.

WASHING MACHINES.—Voss Brothers Manufacturing Company, Davenport, Iowa, has issued an illustrated circular describing its latest model-platform, peg-type and vacuum-type washing machines.

RESISTANCE UNITS.—Enameled resistance units are illustrated and described in a booklet that has been issued by the Ward Leonard Electric Company, Mount Vernon, N. Y. Prices of the resistance units are also given.

SWITCHES.—A two-color folder, publication No. 252, has been issued by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., describing and illustrating its "seventy-fifty" switch for use with electric appliances.

FIELD RHEOSTATS.—The Ward Leonard Electric Company of Mount Vernon, N. Y., has issued some general information on field rheostats in a bulletin. Dimensions, price lists and illustrations of the rheostats are given in the booklet.

STOKERS.—The Combustion Engineering Company of New York has issued bulletin C1, describing its Coxe stokers. This booklet is profusely illustrated with actual installations and shows diagrams of several different kinds of boiler settings.

CONDULETS.—Motor-switch condulets are described in bulletin No. 1000H, now being distributed by the Crouse-Hinds Company, Syracuse, N. Y. Its new steam-type cover with switch-operating mechanism for single and two-gang series condulet bodies is also illustrated in a photo of an actual installation.

MECHANICAL DRIVE.—The Poole Engineering & Machine Company of Baltimore, Md., has issued circulars describing the application of its turbo-gear for rubber-mill drive, pump drive, line-shaft drive, cement-mill drive, belt-conveyor drive, fan drive, air-compressor drive, centrifugal-pump drive and stoker drive.

STEAM TURBINES.—The Terry Steam Turbine Company, Hartford, Conn., is distributing a vacation schedule for 1918 that can be used to show graphically the vacation periods of any number from one to twenty-five employees. Some of the Terry products are shown on the schedule. Copies of this publication will be furnished on request by the company.

INSTRUMENTS.—Engineering instruments are described in a bulletin that is being distributed by James G. Biddle, 1211 Arch Street, Philadelphia. Some of the instruments are meggers for testing electrical resistance of conductors or insulations, hand tachometers, vibrating reed tachometers, reed frequency meters, portable switchboard electrical instruments and rheostats.

ELECTRIC DISTRIBUTION SPECIALTIES.—The G. & W. Electric Specialty Company of Chicago has issued a very complete catalog describing and illustrating its several distribution specialties. In this bulletin series cut-outs, filling compounds, ground-pipe caps and points, primary cut-outs and fuses, line disconnectors, cable and conduit hangers, outlet hoods, potheads, subway cut-outs, distribution boxes, switching boxes, splice boxes and tap boxes are described.

LINE MATERIAL AND ELECTRIC RAILWAY SPECIALTIES.—A complete and comprehensive catalog has been issued by the Drew Electric & Manufacturing Company, Indianapolis, Ind., describing and illustrating its overhead line material and electric railway specialties. It is known as catalog No. 18 and contains specifications and photographs of splices, trolley frogs, trolley crossings, adjustable crossings, section insulators, approachers, triple-beam insulators, pole brackets, line suspensions, feed-in hangers, insulated hangers, cap-and-cone hangers, globe strain insulators, giant strain insulators, standard insulated bolts, porcelain strain insulators, etc. It also contains various accessories used on electric railways. High voltage porcelain insulators are extensively treated, and diagrams are given illustrating construction and sizes. Glass insulators are also described and illustrated.

New Incorporations

THE FREEMAN ELECTRIC COMPANY of Cleveland, Ohio, has been incorporated by Katherine Freeman and Louis Kronenberg.

THE BORDER POWER COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 by S. B., C. J. and J. L. Sauer of New York City.

THE LOCO (OKLA.) LIGHT & FUEL COMPANY has been chartered with a capital stock of $25,000 by Percy W. Newman and W. H. Rader of Loco and G. W. Newman of Dixie, Okla.

L. R. WOOD, INC. of New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture electrical goods. The incorporators are M. H. and L. H. Wood and C. F. Hoffman, 49 Wall Street.

THE PINE BLUFF BATTERY COMPANY of Pine Bluff, Ark., has been chartered by R. G. Craig, Gordon M. Rudd and others. The company is capitalized at $10,000 and proposes to manufacture electric batteries.

THE ROMMEL-GUSSET COMPANY of Louisville, Ky., has been incorporated by John D. Rommel, W. A. Gusset and W. A. Turner. The company is capitalized at $10,000, and proposes to manufacture storage batteries.

THE ANGOLA (IND.) ELECTRIC MANUFACTURING COMPANY has been incorporated with a capital stock of $150,000 by Samuel C. Wolf, Edward C. Kolb and Carl A. Redding. The company proposes to manufacture machinery.

THE INDUSTRIAL APPLIANCES CORPORATION of New York, N. Y., has been incorporated by J. J. Sullivan, N. V. Rothenberg and M. C. Kahl, 35 Nassau Street. The company is capitalized at $10,000 and proposes to manufacture telephone and telegraph devices.

THE STANDARD ELECTRIC ENGINEERING COMPANY of Hammond, Ind., has been chartered by A. R. Stowell, George M. Chapin and Roy W. Weir. The company is capitalized at $100,000 and proposes to manufacture electrical and mechanical apparatus.

THE ELECTRIC RIVETING CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,250,000 to manufacture machinery for electrical riveting. The incorporators are C. L. Rimlinger, M. McLancy and F. A. Armstrong.

THE INTERNATIONAL INSULATING CORPORATION of New York, N. Y., has been incorporated by O. and Heineman, 25 West Forty-fifth Street, and J. Schecter, 10 Wall Street, New York City. The company is capitalized at $60,000 and proposes to manufacture insulating materials.

THE MASTER TELEPHONE SYSTEM OF THE BRONX, New York, N. Y., has been incorporated with a capital stock of $75,000 by L. Poster, 2126 Vyse Avenue; R. Carlin, 945 East 181st Street; M. L. Heller, 2126 Vyse Street, the Bronx. The company proposes to deal in electric sound transmitting devices.

THE IROQUOIS UTILITIES, INC., of Syracuse, N. Y., has been organized by the consolidation of the Randolph Light & Power Company and the Gowanda (N. Y.) Light & Power Company. The company is capitalized at $165,000, and the incorporators are A. M. Ellis, B. H. Shepard and L. S. Chapman of Syracuse.

New England States

CHARLESTOWN, N. H.—The local substation of the Fall Mountain Electric Company was recently destroyed by fire, causing a loss of about $20,000. The main office of the company is located at Bellows Falls, Vt.

RUTLAND, VT.—Plans are being considered by the Rutland Railway, Light & Power Company for extensions to its system. A large number of industries using steam power in this vicinity are contemplating changing the motive power in their plants to electricity.

STOUGHTON, MASS.—After being without street lamps for several weeks the citizens at a special town meeting voted to appropriate $10,000 for lighting the town.

TURNERS FALLS, MASS.—The Franklin Electric Light Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue $25,000 in capital stock, the proceeds to be used for extensions to its local system.

WORCESTER, MASS. — Contract has been awarded by the W. H. Sawyer Lumber Company, 66 Lincoln Street, to L. Rocheford & Son, 44 Front Street, Worcester, for construction of the proposed addition to its boiler plant. The company is also contemplating other extensions to its works.

BRIDGEPORT, CONN.—Contract has been awarded by the United Illuminating Company to Casey & Hurley, 120 Pequonnock Street, Bridgeport, for the erection of an addition 50 ft. by 80 ft. to its plant.

HARTFORD, CONN.—Bids, it is reported, are being asked by the Terry Steam Turbine Company of Hartford for erecting an additional story to two sections of its plant, 40 ft. by 100 ft. and 20 ft. by 200 ft. respectively. The capital stock of the company has been increased from $350,000 to $700,000.

MONTVILLE, CONN.—Permission has been secured and all arrangements made with government officials and others interested by the Eastern Connecticut Power Company for the construction of an electric generating plant across the Thames River near Bartlett's. The proposed work will include the erection of high-tension aerial cables across the Thames River at Montville, which will swing from steel towers on either side of the river, and it has been decided that the minimum clearance shall be 175 ft. Power generated at the plant will be furnished principally to the submarine base near New London; also to the town of Groton and other towns and industries in that district. Fred T. Ley & Company of Springfield, Mass., have contract for construction of the plant.

NEW BRITAIN, CONN.—Contract has been awarded by the New Britain Machine Company to the Aberthaw Construction Company of Boston, Mass., for the construction of a factory, 114 ft. by 340 ft., to be erected on a site recently acquired on the Berlin branch of the New York, New Haven & Hartford Railroad Company.

Middle Atlantic States

ALBANY, N. Y.—Contract has been awarded by the State Board of Health to Gagen & Butler, 1402 Broadway, New York, for electrical work in connection with the construction of the new laboratory to be erected on New Scotland Avenue. The cost of the work is estimated at $10,484.

BROOKLYN, N. Y.—Plans have been filed by the Edison Electric Illuminating Company of Brooklyn for extensions and improvements to its plant on Gold Street, including the erection of an addition to power house. Contract has been awarded to John H. Duncan, foot of Sixty-sixth Street Brooklyn.

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the erection of a new structural shop at the Brooklyn Navy Yard, to cost about $1,000,000. The bureau, it is reported, is considering the construction of a series of drydocks at Weehawken, N. J., to cost about $8,000,000.

BUFFALO, N. Y.—Plans have been filed by the Buffalo General Electric Company for an addition to its generating plant on Staats Street, to cost about $33,700.

BUFFALO, N. Y.—The Buffalo Cereal Company is planning to construct and equip an electric power plant in connection with its proposed new grain elevator and mill at Abbott Road and the Lake Shore Railroad.

BUFFALO, N. Y.—Plans have been filed by Cousins & Sons, 74 Wabash Street, and contract awarded to B. I. Crocker, 57 Builders' Exchange, Buffalo, for the construction of a new boiler plant at its works at Hopkins and Tifft Streets.

BUFFALO, N. Y.—A new switchboard building will be erected in connection with the proposed new plant under construction by the Linde Air Products Company at Broadway and Ideal Streets, to cost about $60,000. J. W. Cowper, Fidelity Building, is contractor.

DEPEW, N. Y.—The Gould Storage Battery Company is contemplating the construction of an addition, about 75 ft. by 90 ft., to its plant.

FAIRPORT, N. Y.—Plans have been prepared by the Douglas Packing Company for an extension, 50 ft. by 75 ft., to its power house on John Street. A. S. Crocker, Mechanics Institute, Rochester, is engineer.

HUDSON, N. Y.—Bids will be received by Mrs. Annie Winsor Allen, president of the board of managers of the New York State Training School for Girls, Hudson, until June 14 for repairs to boiler settings at the New York State Training School for Girls at Hudson. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

NEW YORK, N. Y.—The Public Service Commission has granted the application of the New York Telephone Company for an increase in capital stock of $25,000,000.

NEW YORK, N. Y.—Plans have been prepared by Warren & Wetmore for the erection of a new building for the Mexican Telegraph Company and the Central and South American Telegraph Company on Broad Street, between South William and Stone Streets. The general contract has been awarded to John I. Downey, 410 West Thirty-fourth Street.

OSSINING, N. Y.—Bids will be received by the Commission on New Prisons, Room 618, Hall of Records, New York City, until June 27 for electric work, including underground electric conduit and feeder system, for registration building No. 1; outside cell block No. 2; detention building No. 5; outside cell block No. 7; clinic building No. 8, and pump house at Sing Sing Prison, Ossining. Specifications may be consulted at the office of the warden of Sing Sing Prison, Ossining; at the office of the Commission on New Prisons, Room 618, Hall of Records, New York City; the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Albany, N. Y.

POUGHKEEPSIE, N. Y.—Improvements are contemplated to the waterworks system, including the installation of new electrically operated pumping machinery, a reserve boiler and a new pre-filter bed. The cost of the proposed work is estimated at $65,000.

SCHENECTADY, N. Y.—The Schenectady Illuminating Company has petitioned the Public Service Commission for authority to acquire the property of the East Creek Electric Power Company of St. Johnsville which operates an electric plant on East Canada Creek, supplying the bulk of the power to the Edison Electric Light & Power Company of Amsterdam; also to purchase the plant and system of the Edison Electric Light & Power Company, which has franchises in the city of Amsterdam, the town of Amsterdam, village of Fort Johnson and in Schenectady County.

SYRACUSE, N. Y.—Investigations are being made by Prof. A. R. Acheson, consulting engineer of the Bureau of Gas and Electricity, relative to making changes in the ornamental lighting system in Syracuse. It is understood that the lighting commission will ask that some special arrangement be made for lighting the downtown section during the remainder of the war, with a view toward saving fuel and in co-operation with the fuel administration. It is expected that the illumination will not be so elaborate as during the past few years. The new contract with the Syracuse Lighting Company for street-lighting must be made before July 1.

WARSAW, N. Y.—Plans have been prepared by the Warsaw Elevator Company for an addition to its power house. C. E. Ketchum is president.

WATERTOWN, N. Y.—Plans are being prepared by the Northern Utilities Company for a hydroelectric development at Black Carthage, to cost approximately $500,000. F. A. Rogers is vice-president and general manager.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

WATERVLIET, N. Y.—Bids will be received by the Board of Water Commissioners, City Hall, Watervliet, until June 25 for furnishing material and constructing extensions to the filter and pumping station of the municipal water-works system. The work will include the installation of four additional 500,000-gal. mechanical filter units with extensions to superstructure and piping of present filter plant on the Shaker Road west of the city of Watervliet, together with furnishing and installing a motor-driven centrifugal pump on foundations, with all necessary piping and appurtenances in the pumping station at French's Mills. Plans and specifications are on file at the office of the Board of Water Commissioners, Watervliet, and also at the office of Solomon, Norcross & Keis, Atlanta, Ga.

ATLANTIC CITY, N. J.—John Stafford has awarded contract to the Baird-Osterhout Company for furnishing and installing electric-light and power system, fire-alarm system and public telephone system in the building to be erected at Brighton Avenue and the Boardwalk, at $62,000.

BORDENTOWN, N. J.—Bids will be received at the Department of Architecture, State House, Trenton, N. J., until June 18 for general plumbing, heating and electric work in connection with alterations to tenements, Manual Training and Industrial School at Bordentown. Bids will also be received at the same time and place for general, plumbing, heating and electric work in connection with an administration building and principal's house at the Manual Training and Industrial School, Bordentown. Plans and specifications may be obtained upon application to the Department of Architecture upon deposit of $25 for each set of plans.

HOBOKEN, N. J.—The business of the Bijur Motor Lighting Company of Hoboken has been purchased by the General Electric Company. The company will vacate its new plant and will occupy its old building again. The new Bijur plant will be turned over to the Remington Arms U. M. C. Company, which will make extensions to same for the manufacture of small-arms ammunition. New equipment will probably be purchased soon.

LANDING, N. J.—The Atlas Powder Company of Landing has contracted with the New Jersey Power & Light Company of Dover for furnishing additional power needed to operate its works. The powder company will use about 150,000 kw.-hr. per month, and a connected load of about 300 kw. will be required. Plans are being considered by the New Jersey company for extending its transmission lines to the plant at Landing. The cost is estimated at $5,800.

NEWARK, N. J.—Bids will be received by the Board of Education of Newark until June 10 for general supplies, including electric lamps, electrical supplies, hardware, etc. Specifications and proposal blanks may be obtained at the office of the Department of Supplies, third floor, City Hall, Newark. R. D. Argue is secretary.

NEWARK, N. J.—Contract has been awarded by the Maas & Waldstein Company, Avenue R and Passaic River, Newark, to Henry M. Doremus & Company, 36 Orange Street, Newark, for the construction of a boiler and nitrating chemical works, to cost about $65,000. The buildings will be 55 ft. by 215 ft., and 55 ft. by 128 ft. respectively, one story high. The Maas & Waldstein Company also contemplates the erection of a foundry, 30 ft. by 40 ft., at its chemical works.

PARK RIDGE, N. J.—The Board of Utility Commissioners has handed down an order requiring the local electric lighting company to make various changes and improvements to its system.

PERTH AMBOY, N. J.—The Standard Underground Cable Company, 26 Washington Street, has purchased a site in Woodbridge Township on which it proposes to erect a large new plant. The company manufactures wires, cables, etc.

EASTON, PA.—Notice has been filed with the Public Service Commission by the Pennsylvania Power Company of an issue of $110,000 in bonds, the proceeds to be used for extensions, improvements, etc.

HARRISBURG, PA.—A special meeting of the stockholders of the Harrisburg Light & Power Company has been called for July for the purpose of voting on the proposal to increase the capital stock from $10,000,000 to $10,500,000 to provide for extensions and improvements to its system.

HILLSVILLE, PA.—Preparations are being made by the Bessemer Limestone Company for the installation of an electric haulage system at its Hillsville plant. The present plans provide for an expenditure of about $60,000 in the partial installation. The cost of the complete equipment of the works is estimated at about $200,000.

MEADVILLE, PA.—The Northwestern Electric Service Company is planning to extend its electric lighting service to Kearsage in the near future. C. M. Hatch is manager.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Range Boiler Company, 2024 North Tenth Street, for the construction of an addition to its works. Other improvements are also contemplated.

PHILADELPHIA, PA.—The Philadelphia & Reading Railway Company, Reading Terminal, is considering the construction of a two-story signal tower and battery building at Manville Junction, N. J., for which plans have been prepared.

PHILADELPHIA, PA.—Plans have been filed by the Bellevue Worsted Mills, Wister Street and Reading Railway, for the construction of a new power house to be erected at Sixteenth and Hunting Park Avenues, to cost about $10,000. Contract for building has been awarded to W. E. S. Dyer, Land Title Building, Philadelphia.

SOUTH BETHLEHEM, PA.—Plans have been prepared by the Bethlehem Steel Company for the construction of an addition to its power plant at McAfee, N. J., and also for improvements to the present building.

BALTIMORE, MD.—Contract has been awarded by the Baltimore County Water Company, 100 West Fayette Street, to the Price Construction Company, Maryland Trust Building, Baltimore, for the construction of a new pumping plant to be erected at Falls Road and the Viaduct.

MARLINTON, W. VA.—The erection of a new building at the electric-light and water works plant, to cost about $6,000, is under consideration.

FREDERICKSBURG, VA.—The contract for the construction of the proposed power plant and laundry building at the State Normal School, Fredericksburg, has been awarded to E. G. Heflin, Fredericksburg. The cost is estimated at about $20,000.

MANNINGTON, VA.—Plans are being considered by the Rachel Coal Company for the reconstruction of its power house, compressor and ventilation system, recently destroyed by fire, causing a loss of about $65,000.

NEWPORT NEWS, VA.—The Chesapeake & Potomac Telephone Company has purchased a site in Newport News on which it will erect a new telephone exchange, to cost about $40,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 10 under specification 3041 for electric-light and power system for shipbuilding slip No. 1 at Norfolk, Va. The cost is estimated at about $15,000.

RICHMOND, VA.—Plans and specifications are being prepared by the Newport News (Va.) Shipbuilding & Dry Dock Company for the Emergency Fleet Corporation for the construction of a plant to manufacture boilers for all government steamships being constructed along the Atlantic seaboard. The proposed plant, it is understood, will be located on the James River and will include a foundry, machine shop and boiler shop. Electricity will be used for lighting and power. The cost of the work is estimated at $4,000,000. The Newport News company will have charge of construction of the plant and will operate it for the Emergency Fleet Corporation.

WASHINGTON, D. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to Skinner & Garrett, 1416 F Street, Washington, for construction of an addition to the Walter Reed Hospital, to cost about $750,000.

WASHINGTON, D. C.—Estimates of appropriations required by the Engineer Department for the fiscal year ending June 30, 1918, have been submitted to Congress by the Secretary of War, asking for $1,475,000 for searchlights for defensive purposes, and $800,000 for sound-ranging equipment.

WASHINGTON, D. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, for substation switchboards to the Carroll Electric Company of Washington, D. C., at $48,250. Contract has also been awarded to the White City Electric Company of Washington, for an electric lighting system for shipbuilding slip, at $25,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and western deliveries, Schedule 1831—dry cells; Schedule 1834—various deliveries of weatherproof sockets; Schedule 1835—various deliveries of rubber and cotton insulating tape; Schedule 1839—for various yards, 68,800 flashlights and 181,000 flashlight batteries. Bids will be received until June 11 for furnishing at Washington, D. C., under Schedule 4563½—25 instruction radio sets. Bids will also be received until June 17 for furnishing at the eastern navy yards under Schedule 4577½—fifty searchlights. Bids will also be received until June 17 for furnishing at Washington under Schedule 4577½—243 range and deflector transmitters, 1458 springs and 1270 range and deflector indicators. Further information may be obtained on application to the above bureau.

North Central States

CHEBOYGAN, MICH.—The Cheboygan Electric Light & Power Company has awarded contract for the construction of its new power house at the Black River dam to William Moody.

CHILLICOTHE, OHIO.—Application has been made by the Chillicothe & Camp Sherman Electric Railway Company to the Public Utilities Commission for permission to issue $225,000 in capital stock and $150,000 in bonds, the proceeds to be used for the construction of the proposed electric railway from Chillicothe to Camp Sherman. George A. Vaughters of Chillicothe is interested.

COLUMBUS, OHIO—The Frankenburg Construction Company has been awarded the contract for construction of an addition to the power house at the Smith Agricultural Chemical Company.

FREMONT, OHIO—The City Council is considering the installation of a municipal gas and electric-light plant to be operated in conjunction with the water-works system.

MIDDLETOWN, OHIO—The Hamilton Electric Company submitted the lowest bid ($2,800) for lighting the viaduct between Middletown and West Middletown.

LEXINGTON, KY.—The Elkhorn Coal Company, recently incorporated at Lexington, has acquired the property of the Detroit Elk Coal Company and has increased the capital stock from $100,000 to $600,000. The company holds many acres of valuable timber and coal lands in Kentucky. Development, it is reported, will begin at once with the establishment of electric plants, telephone and telegraphic service and the building of several towns. A. F. Weast, C. C. Winters, A. L. Mancourt and John Koenig of Detroit, Mich., are interested in the project.

SERGEANT, KY.—The Whitley-Elkhorn Coal Company is contemplating the installation of electric equipment.

WHITESBURG, KY.—The Elkhorn Superior Block Coal Company is contemplating the installation of new electrical machinery. The capital stock of the company has been increased from $35,000 to $100,000.

FRANKLIN, IND.—The Franklin Water, Light & Power Company has petitioned the Public Service Commission for permission to issue bonds to provide for extensions and improvements, etc.

PERU, IND.—The property of the Peru Electric Manufacturing Company has been purchased by Frank Moeck of Peru.

LENA, ILL.—The Public Utilities Commission has approved the contract of the Lena Electric Light & Power Company for the joint use of the transmission lines from Lena to Lanark and the lines of the Pearl City Independent Telephone Company, the Stephenson County Telephone Company and the Pearl City Mutual Telephone Company at Pearl City.

ROCKFORD, ILL.—A new special committee, consisting of Aldermen Clothier, Ogren, Murphy, Croon and Johnson, has been appointed by Mayor Rew to investigate the proposition of establishing a municipal electric-light and power plant in Rockford.

WOODSTOCK, ILL.—The Woodstock Typewriter Company, North Dearborn Street, Chicago, is planning to build a power plant at its works in Woodstock, to cost about $10,000.

MILWAUKEE, WIS.—Contract has been awarded by the Lavine Gear Company of Racine to the Dahlman Construction Company of Milwaukee for the construction of a new machine shop and manufacturing plant, 175 ft. by 275 ft., at Keefe Avenue and North Pierce Street, Milwaukee. The cost of the building with equipment is estimated at $350,000.

ROCKDALE, WIS.—The Village Council has granted the Cambridge (Wis.) Electric Light & Power Company a franchise to construct and operate an electric-light and power system in Rockdale.

MUSCATINE, IOWA.—The City Council is considering the question of establishing a municipal electric-lighting plant.

NEOLA, IOWA.—Bonds to the amount of $10,000 have been voted for improvements to the municipal electric-light plant and water-works system.

ADRIAN, MO.—A special election will be held on June 11 to submit to the voters the proposal to grant an electric-light franchise to Mr. Green.

CAMERON, MO.—The installation of a forced draft system in the municipal electric power plant is under consideration by the electric light committee.

JOPLIN, MO.—The Bankers' Mining Company of Joplin is contemplating the installation of new machinery in its concentrating plant, to cost about $25,900.

KANSAS CITY, MO.—Plans are being considered by the A. Holtman Heating Company for rebuilding its plant, recently destroyed by fire. The cost of the proposed new plant is estimated at about $90,000. Smith, Rea & Lovitt of Kansas City are architects.

ST. LOUIS, MO.—The capital stock of the Union Electric Light & Power Company has been increased from $21,240,000 to $22,240,000. The company, it is understood, contemplates improvements to its system.

MILLER, S. D.—Bids will be received by the city auditor, Miller, S. D., until June 17 for additions and improvements to the municipal electric-light plant as follows: (1) Concrete addition to building; (2) an 80,000-gal. steel tank on a 100-ft. steel tower; (3) a 50,000-gal. reinforced concrete reservoir; (4) furnishing and erecting two 72-in. by 16-ft. fire-tube boilers, a 100-ft. concrete chimney, one 75-kw. and one 100-kw., 2300-volt steam engine-driven generating unit, switchboard, two 200-gal. per minute motor-driven centrifugal pumps, steam piping connections and some miscellaneous water and sewer connections; (5) for furnishing and erecting materials for reconstruction of existing alternating-current pole line distribution system in Miller. Plans and specifications may be obtained upon application to Earle D. Jackson, Capital Bank Building, St. Paul, Minn., upon deposit of $10. Plans are on file at the office of the city auditor, Miller.

CEDAR, KAN.—The Solomon Valley Power Company of Downs, it is reported, contemplates some changes in its local wiring system.

CHENEY, KAN.—At an election held recently bonds to the amount of $15,000 were voted, the proceeds to be used to purchase the local electric-lighting plant and for improvements to same.

LARNED, KAN.—Arrangements have been made between the City Council and Nathan L. Jones whereby the latter will purchase the surplus energy from the municipal electric plant. Mr. Jones and associates are planning to erect an electric transmission line up the Pawnee Valley, and from the station of Frizell south to Garfield to connect with a line just completed by Mr. Jones from the line extending to Lewis and Belpre from the plant at Kinsley. Application has been made for a charter for the company.

WELLSVILLE, KAN.—C. A. Smith, owner of the local electric-light plant, has applied for permission to erect an electric transmission line to supply electricity in the towns of Garfield and Edgerton.

Southern States

ATLANTA, GA.—An election will be held on July 10 to submit to the voters the proposal to issue $75,000 in bonds for the installation of an electric generating plant.

BRUNSWICK, GA.—The City Council is considering taking over the water plant of the Mutual Light & Water Company, to be owned and operated by the municipality.

DAVISBORO, GA.—Contract has been awarded by the City Council for the construction of an electric-light plant. The initial installation will provide sufficient electricity to light the streets and business houses. Later an addition will be made to furnish electrical service for domestic purposes. The plant will be driven by a gasoline engine.

BRISTOL, TENN.—The Waggoner, Phillips, Barnes Company, care of the Bristol Ice Company, would like to receive prices, catalogs, etc., on ice-manufacturing machinery, etc.

NASHVILLE, TENN.—Messrs. Morgan & Hamilton of Nashville are erecting an addition to its plant, which will be equipped with motor-driven machinery. The company manufactures bags.

MENA, ARK.—The local electric-light plant, owned by Tomlinson Brothers, has been purchased by the Commonwealth Public Service of Muskogee, Okla., at $24,200. The company also purchased the property of the Mena Ice & Cold Storage Company.

A new electric franchise, it is understood, will be asked by the new company.

RISON, ARK.—The Fordyce (Ark.) Light & Water Company has been granted a franchise to construct and operate a waterworks system in Rison.

POTEAU, OKLA.—The Citizens' Consolidated Power & Electric Company, recently organized, has petitioned the city of Poteau for a franchise to install and operate an electric plant.

BRYAN, TEX.—Material has been ordered for the erection of an electric transmission line from the city limits to the clubhouse and grounds of the Fin-Feather Club, south of the city.

Pacific and Mountain States

BELLINGHAM, WASH.—Plans are being considered by the Boundary Red Mountain Mining Company of Bellingham for replacing its power plant destroyed by fire last winter. It is proposed to install a much larger plant.

CHEHALIS, WASH.—G. O. Anderson has filed a petition with the City Commission for the resubmission of the Anderson franchise for furnishing electricity for lamps and motors in Chehalis to the voters. The franchise was rejected at the election held April 20. Resubmission is asked on account of technical irregularities in the election.

EVERETT, WASH.—Bids are being asked by the United Steel Company for the erection of buildings for its plant. The main building is to be 70 ft. by 200 ft. The company proposes to install two reheat furnaces and an electric furnace. The equipment will also include two large magnets operated by electricity for handling scrap.

NEWPORT, WASH.—A large transformer in the local substation of the Washington Water Power Company was recently destroyed by fire, causing a loss of about $3,000.

OKANOGAN, WASH.—The Okanogan Valley Power Company is contemplating the erection of an electric transmission line between Riverside and Tonasket during the summer.

SEATTLE, WASH.—The Rothert Process Steel Company, 622 Harriman Street, is planning to install a 10-ton electric furnace at its plant in connection with other extensions.

SEATTLE, WASH.—The City Council has passed over the veto of the Mayor a bill granting the National District Telegraph Company a franchise to install a signal alarm system in Seattle.

SEATTLE, WASH.—The War Department has awarded contract to the Aero Alarm Company of Seattle for equipping 2000 hospital buildings in camps and cantonments with aero apparatus.

SEATTLE, WASH.—The City Council has passed an ordinance placing the sealing operations on the basin of the new Cedar River dam under joint supervision of J. D. Ross, superintendent of lighting, and L. B. Young, superintendent of the water department.

SEATTLE, WASH.—The City Council has passed the ordinance providing for the development of a hydroelectric power plant on the Skagit River and for the issuance of $5,500,000 in bonds to cover the cost of the work. The additional $500,000 was suggested by A. H. Dimmock, city engineer, and J. D. Ross, superintendent of lighting, as the original bids did not include the cost of the city substation.

SPOKANE, WASH.—The Spokane Heat, Light & Power Company will not extend its lines into the residential district this year as had been announced. In view of the government's request to curtail all unnecessary extensions in all lines of business, no new patrons will be sought by the company.

VANCOUVER, WASH.—Bids will be received by the Columbia River Interstate Bridge Commission, Vancouver, until June 28, for furnishing material and construction of a transformer house on Washington Street, Vancouver. Plans may be secured at the office of the clerk of Multnomah County at Portland, Ore., or the county auditor of Clarke County at Vancouver.

KLAMATH FALLS, ORE.—The Keno (Ore.) Power Company has submitted a tentative proposal to the city of Klamath Falls offering to sell its plant at Keno to the city to be owned and operated by the municipality. The company was granted a franchise to operate in the city over a year ago.

PORTLAND, ORE.—A permit has been granted to the Northwestern Electric Company for the erection of a power plant at the foot of Lincoln Street, to cost about $250,000. Charles C. Moore & Company are engineers.

ANGELES CAMP, CAL.—Work has begun on unwatering the Pioneer Mine at Angeles Camp. Electricity will be used to operate the machinery in the mine. The company has already taken over the transmission line of the Brown-Smyth-Ryland Company adjoining, together with transformers, etc.

CHOWCHILLA, CAL.—Contract has been awarded by George R. Perry for the construction of a machine shop, 350 ft. by 100 ft., to James Daly, of Fresno. It will be equipped for automobile and tractor engine construction and repairs, with overhead cranes, etc.

FRESNO, CAL.—Rosenburg Brothers & Company, 706 G Street, Fresno, have awarded contract for the construction of a new packing plant to the Clinton Construction Company, Townsend Street, San Francisco. The plans provide for the erection of a power plant, 45 ft. by 85 ft. The cost of the entire plant is estimated at about $200,000.

JACKSON, CAL.—Plans are being considered by the Gage Mining Company, located near Shawmut, for equipping the machinery in its mines for electrical operation. Electricity will be supplied by the Sierra & San Francisco Power Company of San Francisco.

LOMPOC, CAL.—The Lompoc Light & Power Company is contemplating improvements to its plant and distributing system, involving an expenditure of between $5,000 and $10,000.

LOS ANGELES, CAL.—Preparations are being made by the Pacific Electric Railway Company for the construction of an electric substation, 32 ft. by 50 ft., to be located at Slauson Junction, Slauson and Long Beach Avenues.

LOS ANGELES, CAL.—Plans have been prepared by the General Petroleum Company, Higgins Building, for the erection of a new machine shop, 40 ft. by 100 ft., one story high.

LOS ANGELES, CAL.—The Water Department is considering equipping four of the waterworks pumping plants for electrical operation. The plants to be operated by electricity are located at Wilmington, Edendale and Garvanza. William Mulholland is chief engineer in the water department.

REDDING, CAL.—The California-Oregon Power Company is planning to erect a high-tension transmission line from its southern terminus at Castella to Kennett, at a cost of about $330,000, and to furnish electricity to the Mammoth mine and smelter for a minimum of $105,000 per year. The Northern California Power Company of San Francisco, it is said, will reinforce its transmission line from the Coleman power house to Hamilton, at a cost of $110,000, and deliver energy at Colusa to the Pacific Gas & Electric Company. Improvements, involving an expenditure of about $3,000,000, are contemplated by the three companies.

SAN PEDRO, CAL.—Extensive additions are being made to the plant of the Southwestern Shipbuilding Company, located south of Fish Harbor Wharf, which will include the erection of a transformer station, 20 ft. by 27 ft.

SANTA BARBARA, CAL.—The City Council has adopted a resolution authorizing the installation of an ornamental lighting system on Chapel Street from Ocean Boulevard to Guterrez Street.

SANTA BARBARA, CAL.—The City Council has granted the Santa Barbara Telephone Company a franchise to erect and maintain pole lines, etc., and to lay underground conductors for wires on and under the streets, alleys and avenues in Santa Barbara.

TORRANCE, CAL.—The Pacific Electric Railway of Los Angeles has awarded contract to the Wurster Construction Company, Central Avenue, Los Angeles, for the construction of its new shops at Torrance as follows: Car works, 180 ft. by 450 ft.; forge shop, 150 ft. by 200 ft.; erecting shops, 180 ft. by 450 ft.; paint shop, 180 ft. by 450 ft.; power plant, 60 ft. by 120 ft., and other structures. The cost of the entire works is estimated at $1,000,000.

WINTERHAVEN, CAL.—The Board of Supervisors has granted the Winterhaven Improvement Company a franchise to construct and operate an electric-light and power plant, waterworks and gas plant in Winterhaven.

BOISE, IDAHO.—The Public Utilities Commission has granted the Idaho Power Company permission to cancel its air-heating contracts in Twin County, contracts to be abrogated at once, except in hospitals and homes where there is sickness. The heavy load on the Shoshone plant since the opening of the irrigation season has made the cancellation of the contracts necessary.

BEAVER, UTAH.—The Beaver River Power Company is contemplating extending its electric transmission line to the sulphur mine near Cove Front, northeast of Milford.

SALT LAKE CITY, UTAH—The lighting and heating plant, laundry, engine room and part of the nurses' quarters at the St. Mark Hospital were recently damaged by fire.

SALT LAKE CITY, UTAH—The County Commissioners have authorized the county attorney to draw up a contract with the Utah Power & Light Company for the installation of 98 lamp posts on the Redwood Road and 177 on State Street.

SELIGMAN, ARIZ.—Surveys have been made for a large hydroelectric development on the Colorado River north of Seligman. E. L. Beyard of Seligman may be able to give further information.

SACO, MONT.—Arrangements are being made by D. T. Gilbert, owner of the local electric-light plant, for extensions and improvements to his plant.

MINA, NEV.—The installation of new electric machinery in the new 100-ton concentrating plant to be erected at the Gunmetal tungsten mine, about 2 miles from Mina, is under consideration.

PALISADE, NEV.—The installation of considerable new electric machinery in connection with the construction of a new large concentrating plant is under consideration by the Union Mines Company.

TONOPAH, NEV.—Work has begun on the erection of the new Tonopah-Gold Mountain transmission line of the Nevada-California Power Company. The proposed line will be extended from the Jim Butler mine to the property of the Tonapah Divide Company and other Gould Mountain companies.

DEMING, N. M.—The Deming Ice & Electric Company is contemplating the installation of new machinery at its plant.

Canada

VANCOUVER, B. C.—Mundy, Rowland & Company of Vancouver have been awarded the contract for the electrical work on the Manitoba Parliament Buildings at Winnipeg, amounting to more than $100,000. The company has also secured the contract for the electrical installation in the Saskatchewan Co-operative Hospital at Port Arthur, Ont., at $25,000.

HAMILTON, ONT.—Tenders will be received by Charles G. Booker, Mayor, addressed to S. H. Kent, city clerk, Hamilton, until June 17 for furnishing and installing two 200-hp. water-tube boilers or one 400-hp. water-tube boiler. Specifications and form of tender may be obtained at the office of the engineer.

DRUMMONDVILLE, QUE.—The Southern Canada Power Company has awarded contract for the construction of a dam and concrete power house on the St. Francis River, near Drummondville, to Morrow & Beatty of Peterboro, Ont. The company is planning for a development of 10,000 hp. at present, but will make provision in the power house for an ultimate development of 18,000 hp.

HULL, QUE.—The Hull Electric Company is considering making extensions to its system.

MONTREAL, QUE.—The contract for rebuilding the hydroelectric plant for the College de Montfort, including a concrete dam, a wooden-stave pipe line and a brick and concrete power house, has been awarded to Arsenault & Plamondon, Ltd., of Montreal.

SHAWINIGAN FALLS, QUE.—Work, it is reported, will soon begin on the construction of a new plant for the Canadian Ferro-Alloys Company, to cost about $100,000.

LLOYDMINSTER, SASK.—The installation of an electric-lighting plant, to cost about $60,000, is under consideration by William and E. Johnson of Lloydminster.

Miscellaneous

MANILA, P. I.—Arrangements are being made by the Manila Electric Railway & Light Company for extensions to its power plant. New equipment, including one 5000-kw. turbine and a 10,000-sq. ft. condenser, one 1000-kw. rotary, one 100-kw. M. G. exciter, switchboard, etc., has recently been purchased from the Westinghouse Electric & Manufacturing Company and six 6-retort Taylor stokers. The company, it is understood, will soon purchase an economizer and induced-draft fans.

Record of Electrical Patents

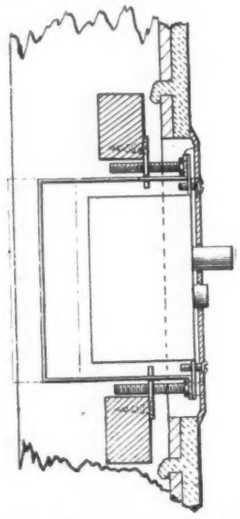
Notes on United States Patents

(Issued May 7, 1918.)

1,265,633. Automatic Wireless Signal; Gustaf Engelbrekt, Superior, Wis. App. filed June 27, 1916. Automatic means whereby signals may be sent out and received in alternation during brief periods or periods sufficiently prolonged to become effective.

1,265,665. Leading-in Conductor; Richard Jaeoby, Berlin, Germany. App. filed April 8, 1914. For incandescent lamps, gas-electric lamps, mercury rectifiers and apparatus of a similar nature in which a glass or vitreous envelope is used.

1,265,697. Electric Switch; Frank E. Summers, near Memphis, Mo. App. filed June 24, 1915. Knife switch.



1,265,744—Wall Box for Electrical Apparatus

1,265,716. Measured-Service Telephone System; George A. Yanochowski, Chicago, Ill. App. filed Feb. 4, 1914. A simplified cord circuit for use in semi-automatic systems.

(Issued May 14, 1918.)

1,265,728. Telegraph System; John H. Bell, East Orange, N. J. App. filed July 12, 1917. Reproduces signals in the form of a printed record.

1,265,744. Wall Box for Electrical Apparatus; Clair C. Canfield, Crafton, Pa. App. filed April 6, 1915. Improvements.

1,265,749. Signal Box with Local Alarm Mechanism; Frederick W. Cole, Newton, Mass. App. filed May 10, 1915. Box having a normally unwound signaling mechanism.

1,265,751. Signaling System; Roy D. Conway, Chatham, N. J. App. filed July 9, 1917. Signaling on composite telegraph and telephone circuits.

1,265,765. Electrothermostatic Device; Harry A. Ferris, Cheyenne, Wyo. App. filed March 2, 1917. Devices for shifting valves or the like, etc.

1,265,820. Flashlight; Edward W. Seymour, New York, N. Y. App. filed April 10, 1917. Pocket lamp.

1,265,829. Electric Railway System; Kenneth E. Stuart, Philadelphia, Pa. App. filed Aug. 29, 1914. For electric railway system where the motor cars are automatically controlled.

1,265,830. Polarized Repeating Sounder; Adolph Swoboda, Montclair, N. J. App. filed Sept. 13, 1915. Telegraph sounders.

1,265,849. Electric Water Heater; Jesse F. Wheelock, Dobbins, Cal. App. filed May 19, 1914. Improvements.

1,265,851. Mechanism for Installing Transmission-Line Wires; Harry C. Williams, Irvington, N. J. App. filed Nov. 2, 1917. Improvements.

1,265,873. Brush Mount for Electric Motors; Joseph Berg, Chicago, Ill. App. filed Jan. 27, 1917. Improvements.

1,265,875. Pipe Connection; Carl H. Bissel, Syracuse, N. Y. App. filed June 2, 1913. Pipe connection for electrical conduits and service boxes.

1,265,879. Combination Terminal and Fixture Box; David Byrne, Toledo, Ohio. App. filed July 30, 1917. Provides a means whereby a terminal box or plate can be formed into a fixture box or plate.

1,265,884. Electric Regulation; John L. Creveling, New York, N. Y. App. filed Sept. 29, 1911. Automatically regulating dynamo when used to charge a storage battery.

1,265,885. Lighting Fixture; David Crownfield, Cambridge, Mass. App. filed Dec. 4, 1916. Lighting fixture for use on the walls of a hospital ward.

1,265,887. Telegraph Key; Benjamin de Alcala, New Orleans, La. App. filed March 6, 1917. A telegraph key which automatically completes the circuit.

1,265,911. Multiple-Friction-Disk Device; Clark T. Henderson, Milwaukee, Wis. App. filed Feb. 1, 1913. Improvements that provide for the ventilation of the disks, etc.

1,265,918. Circuit Breaker and Distributer Unit; William O. Kennington, Detroit, Mich. App. filed April 14, 1916. For ignition apparatus.

1,265,927. Heat-Regulating System; Harry Lewis, William R. Scott and Charles Dell, Pittsburgh, Pa. App. filed June 1, 1916. Involves use of a thermostat and a valve with an electromagnet.

1,265,945. Electric Furnace; Hans Nathusius, Friedenshutte, Kreis Beuthen, Germany. App. filed Jan. 15, 1914. Heated by means of electric resistances.

1,265,959. Rotary Spark Gap; Robert C. Richter, New York, N. Y. App. filed April 13, 1917. Spark gaps used in radio communication.

1,265,973. Electric Zinc-Distilling Furnace and Condenser; John Thomson, New York, N. Y. App. filed Jan. 19, 1916. Furnaces and condensers for the metallurgy of zinc.

1,265,998. Metering Panel; Henry H. Curtis, Springfield, Mass. App filed April 6, 1917. Assembles blocks or sections of insulating material.

1,266,006. Cable Construction; Henry W. Fisher, Huguenot Park, N. Y. App. filed July 10, 1916. Method used in construction of a multiple-conductor cable.

1,266,057. Electric Brake Device; Alson C. Sargent Des Moines, Iowa. App. filed Oct. 12, 1915. For automobiles.

1,266,062. Electric Motor for Talking Machines; Howard A. Selah, Newark, N. J. App. filed Dec. 7, 1915. Direct-current induction motor for operating the turntable of talking machines.

1,266,063. Magneto; Luther J. Sevison, Constantine, Mich. App. filed Aug. 10, 1908. For high-tension ignition system

1,266,094. Electric Welding Machine; Edmund J. von Henke, Lynn Mass. App. filed May 14, 1917. Embodies a transformer.

1,266,095. Multiple Fuse; Louis B. Bennett, Detroit, Mich. App. filed March 26, 1917. Fuses mounted in a screw-plug engage with a socket fitting in the electric circuit.

1,266,101. Signal Device for Automobiles; William J. Bunyan, Cleveland, Ohio. App. filed Oct. 12, 1917. Red and blue lights are controlled by a switch.

1,266,114. Cord Terminal; Arthur E. Francis Cleveland, Ohio. App. filed Aug. 17, 1917. Connectors adapted for connecting wires with spark plugs of internal-combustion engines.

1,266,143. Sprinkler Electric Signal System; James D. Nelson, Cincinnati, Ohio. App. filed April 19, 1917. For supervising sprinkler system.

1,266,114. Electric Signal System; James D. Nelson, Cincinnati, Ohio. App. filed May 5, 1917. For indicating a flow of water through automatic fire extinguisher systems.

1,266,150. Electric Signaling System for Railway Trains; Nicholas Pignataro, Hilton, N. J. App. filed Jan. 16, 1914. Safety appliances for railroads.

1,266,158. Railway-Train Dispatching Circuit; William Reid, Chicago, Ill. App. filed Sept. 8, 1914. Provides a balanced receiving circuit.

1,266,166. Battery Cell; John C. Sangers, Cleveland, Ohio. App. filed Oct. 15, 1917. Dry-cell type.

1,266,175. Lightning Protector; Nikola Tesla, New York, N. Y. App. filed May 6, 1916. Lightning protectors in which the terminal has a large surface.

1,266,180. Electric Controller; Herbert S. Valentine, Philadelphia, Pa. App. filed June 30, 1915. Controller finger automatically adjusts itself.

1,266,190. Circuit-Changing Switch; Arthur H. Adams, Sparkill, N. Y. App. filed Dec. 9, 1916. Register controller in automatic telephone systems.

1,266,206. Electric Switch; Charles W. Brockett, Brooklyn, N. Y. App. filed June 26, 1916. Key-socket type.

1,266,209. Electrical Ground; Thomas W. Byrne, Boston, Mass. App. filed March 16, 1917. Ground of carbon, which is noncorrosive.

1,266,259. Gearing; Otto Heins, New York, N. Y. App. filed July 27, 1916. Improvements.

1,266,287. High-Frequency Apparatus; Antonio Longoria, Cleveland, Ohio. App. filed Aug. 10, 1914. For therapeutical purposes.

1,266,302. Dynamo-Electric Machine; Alfons H. Neuland, New York, N. Y. App. filed Feb. 10, 1915. Alternators have relatively low angular and peripheral speed; suitable for wireless signaling.

1,266,303. Electromagnetic Power-Transmitting Apparatus; Alfons H. Neuland, San Francisco, Cal. App. filed Aug. 8, 1914. Adapted to transmit power from one rotatable element to another.

1,266,329. Electro-Osmotic Extraction of Water from Animal, Vegetable and Mineral Substances; Botho Scherwin, Frankfort-on-the-Main, Germany. App. filed Nov. 20, 1912. Electro-osmotic process in conjunction with mechanical pressure.

1,266,330. Process for Removing Liquid from Steatite; Botho Scherwin, Frankfort-on-the-Main, Germany. App. filed Nov. 11, 1914. Removing of water from steatite by electro-osmosis.

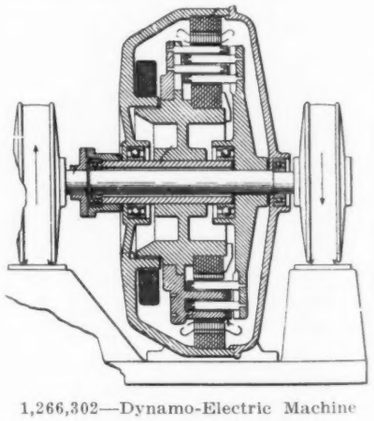
1,266,347. Electric Meter; Elihu Thomson, Swampscott, Mass. App. filed April 6, 1916. Direct-current meter of the motor type.

1,266,377. Condenser; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Nov. 26, 1915. For the protection of distribution systems.

1,266,388. Dynamo-Electric Machine; Sven R. Bergman, Nahant, Mass. App. filed May 13, 1916. Embodies a distributed compensating winding.

1,266,389. Automatic Wireless Apparatus for Preventing Collisions; Harry D. Betz, Kansas City, Mo. App. filed Dec. 20, 1913. Wireless apparatus for automatically stopping a railway locomotive.

1,266,405. Railway Signal and Train-Stop System; John B. Casselman, Oakland, Cal. App. filed June 29, 1914. Automatic signal system.



1,266,302—Dynamo-Electric Machine

1,266,420. Switch; William W. Dean, Chicago, Ill. App. filed Nov. 7, 1913. For electric alarms for motorcycles, etc.

1,266,421. Signaling Device; William W. Dean, Chicago, Ill. App. filed May 18, 1914. For use in connection with automobiles, motorcycles, etc.

1,266,424. Electric Switch; Frank C. De Reamer, Schenectady, N. Y. App. filed Dec. 11, 1916. For vacuum cleaners.

1,266,434. Protection Against Excessive Voltages; Hans Engel, Charlottenburg, Germany. App. filed July 14, 1915. For preventing current rushes and excessive voltages when transformers are connected to high-voltage supply circuits.